

HOVAF17	595	576627	1 - 344	15 - 358	AA143074, AA987383, W60511, AA680304, AA827641, AA308290, AA401334, F25999, AA313726, F22587, AI358423, AA315506, AI141189, W58769, AA575866, AA515848, F19218, F19304, AA156103, F37437, F33656, N98867, F25212, AA740468, AA157759, AA28989, F24956, AA608827, F36060, AA737291, AA194358, AA932208, AI143027, F24362, F31772, F27422, F32057, T57362, AA192185, F24856, AA995725, AA741404, AA314904, F34156, AA889507, AW022412, N55638, F20992, AA526390, W90626, AA007592, F21312, AA954254, AI749361, AA148433, AA579682, F29723, T57445, AI291661, AI282169, F29662, AA491525, AA747585, F22463, F29957, F31884, AI536594, AA664969, F31246, F33617, AA730678, AA385186, F35367, F20491, F29466, F37060, F24202, AA705812, AA492193, AA382505, W88582, AA314719, F34612, W04663, AA157650, F30675, F23580, F27384, F31800, F27612, AI933136, AA974467, F35170, AI826775, AA528421, F29578, F23463, AA767198, F34150, F24124, AA384045, AA492088, F27860, N56464, F31547, F34856, AA594575, AI276978, F33998, AA316521, AI133697, F28088, F29835, F37748, AI384039, AI810403, W81175, AI867973, T74339, AI701341, AA639064, AA976781, AW241684, AA247353, AA007389, F23553, N89217, F27386, T23491, Z40911, T16443, W90249, and AB017710.
HOVAF71	596	757294	1 - 370	15 - 384	
HOVAG49	597	927320	1 - 479	15 - 493	
HOVA141	598	670963	1 - 93	15 - 107	HI13051, R31396, Z36861, AC007057, and AL049872. AW449247, AI089920, AW452240, AI378795, AA431282, AI188684, AI800797, AA236983, AI078809, AI147017, W07506, AI217995, AA976845, AI093869, AA405781, AI150770, AA405716, AI014997, AA235925, AA578443, AA257058, AA773503, and AL078474. AA846482, AA728911, AL043212, AI653783, T47138, AA832016, AA831801, AI185394, F31951, T52772, AW079737, AW271085, AA714073, AA552724, AA810154, AA018923, AA012829, AA633565, AI061619, AI306717, AW419389, H91047, AI800343, AI342786, AI300413, AA356376, AA846923, AA496309, AI915081, AA745628, AA298569, H43183, AI417586, AA640252, AW019964, H62550, AI873627, T40629, AA053463, AI300818, AI310992, AW302670, AI270120, AA230146, AA805848, AI671077, AW084173, AA568856, AL134332, AA626632, AI583291, AA366601, T62078, AI904944, AI133418, AA862029, AA513884, AI889579, AW002330, AI479148, AA568314, AA768179, AI278847, AI627868, AA297789, AI434037, AI251809, R84528, AW272640, AI130709, M78021, AI536858, AI537995, AW073598, AW089016, AI287766, AA434078, AA745543, AI039761, AI281818, F31811, AI445373, AA742775, AI619994, AA811954, N69399, AI302277, AA167179, AA678616, AW341955, AI814682, AW243945, AI291439, AA715605, AI134418, AA728874,
HOVAM50	599	723671	1 - 350	15 - 364	
HOVAO76	600	770066	1 - 860	15 - 874	
HOVBQ10	601	964671	1 - 808	15 - 822	
HOVBV34	602	706816	1 - 404	15 - 418	

H73306, AL037632, AL041375, H84412, H43771, AW078821, A1431513, R70883, A1904211, AA173166, A1678476, AA856866, AA469282, R87912, AW169118, AAG33039, AW390284, AW117723, AA569597, A1347665, H67172, A1865776, AA244181, AA714921, A1955029, AW190277, R87883, A1472736, A1591134, H42893, N91138, AW079667, AW089950, AA599532, R70884, AW272815, AA644223, AW148775, N73060, AA371410, AA420729, AW440368, A1343669, A1064781, A1309121, AA581498, A1583466, AW274191, A1306232, A1251576, A1733856, A1612810, A1817108, AA678932, A1811647, AW002831, AW081610, AA483606, AA019003, A1816058, AA515351, A1628859, AA229988, AA363003, H86221, T74524, AA937809, AA515924, H29914, AL039309, AA630845, A1889995, A1859744, AW117704, AA302661, A1370170, AC006487, AP000555, AC006312, U18271, AC005231, AC005037, U73330, AC002467, AC004491, AC005288, AC004843, AL008629, AC007686, AC007298, AC004878, AL031120, AC007269, AF027390, AC007055, AF039906, AP000300, AP000113, AP000045, AC005740, AC005529, AC003101, AC004526, AF112482, Z79996, AC003086, AL096761, AC002544, AJ246003, AP000884, AC009247, AC004651, AC004760, AF176815, AC005005, AC006111, AL121658, AC005003, AC008078, AC004991, AL024508, AC005553, AB023050, AP000212, AP000134, AC005089, AC006061, AC004601, AC005684, AC006101, AP000350, AL121754, AC008064, AL096775, AC005532, AC004883, AL096791, AC007514, Z98304, AL031575, U95739, Z83845, AL031005, AL031433, AC002117, U51244, AL031585, AL049575, AL049550, AC008082, AC006449, AC003051, AC004084, AL049610, AC007225, U91319, U91320, AC008545, AC002549, AL031584, AC007344, AL022318, AC008040, AC005940, AF115566, AL109758, U95742, AL117351, AL034423, AF111169, AC006392, AC002543, Z81365, AC005081, AC007277, AC004692, AL049776, AC005015, M87889, AC000090, AP000252, AC005031, AP000030, U80017, AL022396, AC004655, AC006360, AC004025, AC007666, AC004686, U02047, AP000122, AP000034, AL121825, AP000289, AC005480, AP000042, AP000110, AL008730, AL031289, AC005011, AC007182, AL121652, Z98036, AB003151, Z95114, AC004687, AL096818, Z48051, AC002100, AP000067, AC006162, L47234, Z83733, AL035072, AL049749, AC003983, AC000159, AF196970, AL031429, AL031664, AP000355, AL023775, AL031737, AF001552, AC004896, AC005519, U94776, Z75407, AL109627, AL035422, AC007358, AC003108, AC005899, AF196779, AC000134, AL031431, AC006238, AC005602, AL049872, AC005409, Z85986, AL049764, AD000812, AC003072, AL049733, AL023575, AC002126, AL035681, Z93930, AC004540, AC006501, AC000111, AC006013, AL031228, AC004895, AC004776, AC005924, AL080250, AC004000, L78810, AC004231, AL031311, AL117337, AC007736, AC005722, AC005274, AF205588, AP000116, AP000049, AC005247, AL021878, Z99716, AC003690, AL022574, AC004073, AL008635, AC004535, AF196969, AL031295, AF207550, AL078603, AL033381, Z83820, AC007878, AC009509, AC005036, AF130343, AC005207, AP000311,				
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HOVBZ26	603	888442	1 - 203	15 - 217	
HOVCA52	604	727170	1 - 409	15 - 423	
HOVCD39	605	705406	1 - 360	15 - 374	AA535937, AC002314, AC005206, AC005667, AL049832, AC005668, AF111169, AL022316, AC007376, AF001549, AC006160, AC005412, AC007955, U78027, AC007041, AL035422, AC006285, AC005261, AC007227, AF134726, AL031311, X14448, AC005786, AC006257, and AL049830.
HOVCI76	606	858845	1 - 346	15 - 360	AL049694.
HOVCJ77	607	713792	1 - 263	15 - 277	
HOVCJ24	608	858844	1 - 305	15 - 319	
HOVCM22	609	674177	1 - 475	15 - 489	AF150146.
HOVCO11	610	970814	1 - 1454	15 - 1468	AI923848, AI680189, AI401617, AI373875, AA455317, AA701656, AI472034, AI573004, AL120931, AA398429, AI051123, AI624093, AI248617, H99041, AI355692, AA687849, AI355703, AI359209, AA757226, AW131426, N33217, N91144, AI342620, N27564, AI298478, AI589126, AW193312, AI923367, AI890992, AI435647, AA788753, AA601557, AI682609, AI583218, AA678000, AW168929, AA614659, AI298694, AA036731, N66889, H97544, AA745905, D62527, H18598, N89744, AI245176, AA403052, AA150090, AI248821, AI287545, N22090, AI263846, AI245198, AA894619, AI185100, AI272966, R69930, AI075972, AI242237, AI435894, AI348194, AA479068, H46858, AI811692, N47754, AI784586, AW058621, AW081918, AW168028, AI346563, AI566456, AI186661, AI433476, AI770052, AI963008, AI187073, R69882, AA812522, AI888697, F36516, AI890986, AA514269, F11075, C02214, AW002830, AA381400, AA381382, AI143203, AI350680, AI375753, AA968981, AI432046, AI080704, AW169284, AI866206, AA150159, AA381630, AI566594, AA381701, AA381636, R76807, R20526, AA844237, AA381643, R27302, AA381945, AA904561, AI280761, R66707, AI382360, H04179, D61736, AI697429, AW378387, R67586, AA805532, AA381644, AI932870, N93493, AA381602, H18624, AA381460, AA381275, AA476343, AA654417, AW104101, N90151, AI805033, AA347509, R32649, R33334, F31071, AW051256, N56395, AA455704, AA744342, AA291227, AA089961, AA761970, N40385, W17019, R07700, N41931, AW021551, R66241, AA284149, AA381605, R52479, T75133, R75976, AW152083, AA167390, W81443, AA804381, AA366783, AW057830, AA482823, AF139791, AA427526, H27061, AA909840, AI802150, AW378359, AA808476, AI679723, AA765452, H39601, AA889282, H18597, AI679152, W04813, AI216644, AW378412, AA036938, T20149, AI915452.

HOVCO58	611	736065	1 - 408		15 - 422	AA130568, R33333, AI570298, N34507, AI280767, AA632567, AA216333, and AC004520.
HOVCQ47	612	496190	1 - 628		15 - 642	AA176289, AI341253, AI476272, AI631533, AA609460, AA503370, AI797388, AA421578, AA421007, and AA310749.
HOVDY04	613	926219	1 - 532		15 - 546	AA725889, AI937507, AI090742, AI190613, AI363396, AA485978, AW137065, AI061260, AA029073, AW449608, AA488604, AA928760, AI560967, AA908207, AI499789, AI499666, AI638627, AI638193, AA670299, AI699081, AI695989, AI538115, AA700477, AA969203, AW207595, AW007189, AA693349, AA029072, AW453024, AI119457, AI119324, AI119418, AW392670, Z99396, AI119443, AL042544, AL119399, AW372827, AW384394, AL119319, AW363220, AL119497, AL134902, U46351, AL119484, AL119391, AL119522, AL119363, AL119355, AL119483, U46350, U46341, AL119341, AL119335, AL119396, U46349, AL119496, U46347, AL042965, AL037205, AL119464, AL119444, AL119401, AL119439, AL134525, AL134536, U46346, AL134538, AL134531, AL042614, AL042984, AL043019, AL042975, U46345, AL043029, AL042542, AL042551, AI142132, AL042450, AL043003, AR060234, AR066494, A81671, AB026436, AR054110, and AR069079.
HOVEE58	614	968699	1 - 251		15 - 265	AA370036.
HOVEK70	615	909138	1 - 804		15 - 818	AI126171, AI807074, AW172978, AI802445, AI811298, AI624106, AI635206, W96514, AI190433, AI810701, AI271523, H43143, AI911113, AI803788, AI566934, AI187824, AA644026, AL043767, AI869010, AI015017, R55050, AA043579, AL045986, W96481, and AA568260.
HOVEV36	616	959234	1 - 531		15 - 545	
HOVJA10	617	961467	1 - 430		15 - 444	
HP CAB21	618	573829	1 - 141		15 - 155	
HP CAB31	619	698320	1 - 456		15 - 470	R73849.
HP CAE18	620	574952	1 - 343		15 - 357	AI910277, AW339592, AI492757, AA767543, AA568133, AB014555, and AB013384.
HP CAH18	621	573395	1 - 337		15 - 351	AL096817.
HP CAH88	622	933808	1 - 624		15 - 638	
HP CAI21	623	655535	1 - 293		15 - 307	
HP CAI68	624	655536	1 - 346		15 - 360	
HP CAK16	625	662121	1 - 622		15 - 636	
HP CAK57	626	734931	1 - 407		15 - 421	AL031665.
HP CAL60	627	655723	1 - 317		15 - 331	AI287445.
HP CAL86	628	924709	1 - 308		15 - 322	
HP CAM22	629	655607	1 - 415		15 - 429	AC002381.
HP CAN59	630	655742	1 - 282		15 - 296	

HPCAO04	631	655732	1 - 316	15 - 330	AA622352, and Z18305.
HPCPF05	632	927168	1 - 525	15 - 539	AW294804, AI193110, AI300529, AI336265, AI160012, AA029612, AI832813, AA722195, AA121508, AI860181, AI141465, AI570532, AI857944, R32118, AA099271, AI096365, AI342221, AI808491, AI862033, AI559677, AW023430, AI361255, AI371048, AA865682, AA748042, AI336001, AW022229, AI359397, AA026111, AA115634, AI431331, AI911906, AI680468, W93126, AI954960, AW088396, AI190286, AI346804, AI130942, AI091483, AW189276, AA688307, AI189025, AI767694, AI799469, AW380356, AA807668, AI354954, AW380375, AA043929, AW022523, W02100, H92712, AI301595, AI202850, AW380384, H99705, AI982790, AW237470, R65725, AA098892, AA470877, R24056, AA564293, AI651164, AW271629, AW380377, AA853830, TI7200, AA468597, AI651187, R79227, AI686761, AI805208, AA873325, AI077608, R32496, N80064, AI758913, C00620, AI214710, AI783865, AW380370, AA127733, N91757, R65726, AI689514, AI687869, W07026, W00844, AP000315, AP000165, and AP000118.
HPCPO07	633	951826	1 - 289	15 - 303	
HPCQY57	634	927135	1 - 357	15 - 371	AW008782, AW050625, AI631996, AI738644, AW050639, AI826984, AI865021, AI823343, AI983601, AI522217, AW195206, AI748866, AI439278, and AF157630.
HPDOT03	635	922481	1 - 370	15 - 384	AI929455, AI816461, AI650907, AW138789, AA577366, AI633916, AA974004, and W57636.
HPDOY06	636	929318	1 - 243	15 - 257	
HPDPJ69	637	966158	1 - 592	15 - 606	
HPDPK12	638	969340	1 - 304	15 - 318	AW168960, AA833900, AA384359, AI761053, AW169324, AL080317, AL031073, AF179874, AC007068, Z98750, AC007319, AC006047, D84394, and AP000509. AA424185, R07403, AI074550, AI074543, AA829693, AA603234, M77858, H56912, AA193445, AA640755, AA296002, N72812, AI803827, N63746, T85040, AA346355, AA865344, W37250, AW245054, AA278641, AI803791, AA669238, AI708384, W42997, AW075979, N71033, T63772, AA189154, R43401, AA837708, C14614, AW073510, R65651, AA504561, AW438765, AI473581, AA740297, AI224583, AA282951, AI049845, AI027056, AI689695, AI192839, AW151713, AI554399, N22797, AA657505, AA129133, AA088727, AA830594, AA569474, AA586661, T92947, AI821239, AW150476, AI350189, AI611331, AI421257, AI362442, H65404, AW342029, AW166879, AI340280, AI433131, AW440315, AI761120, AI342863, AA974503, AI611736, AA748913, AA483211, AW082470, AA299220, C05714, AA526630, H73230, AI702522, AI791336, AA532594, Z83822, AC007676, AL078593, AL117338, AL110161, AC004070, AC002412, AC005911, AL109853, AL049759, AC006115, AC005944, AC004750, AC004647, AL049776, AC005060, AD000833, AL096766, AC004149, AL078644, AC002563, AC005519, AC009247, AC007461, AI133445, Z93242, Z97056, AC005682, AC004771, Z82180, AF003626, AC008044, AL035667, AL009179, U52112, AC006265, AL135744, AP000959, AI022313, AP000011, AL132712, AC009178, AC007790, AC006597, AC007546, U95742, AC007216, AC000088, AC000082, AC003037, AC006511,

						AC006197, AL035400, AL079295, AR060469, AC006140, AB023052, AC005933, Z82976, AC004559, AC005943, Z84721, AL050306, AL023575, AC006974, AP000513, AL050341, AC005004, AC005281, AC004796, AL034408, AC004686, AC006571, AC004126, AC007425, AL031848, AF064862, AC002553, Z83844, AP000555, AC005618, AL110505, AC005037, AC004893, AC005150, AF141309, AC005544, AC004655, AC006001, AC005089, S77127, AB023049, AC004188, AL021807, AC006071, AP000516, AL035659, AC003663, AC007666, AF159056, AC007214, AC006033, AC003080, AF111169, AC000052, AC004019, AJ011930, AC007051, AF001552, AC003982, AC007919, AC003953, AC007685, AC005666, M87896, AL022324, U63630, AP000302, AC000073, AC006162, M89651, AC004073, AC005183, AL023578, Z98752, AP000114, AP000046, AP000141, AC000085, AL031133, AC006539, AC004150, AP001054, AC002477, AC006236, AC004659, AF001548, AC006036, AL133353, AC004832, AP000088, AC006116, AC004386, AL031283, AC006249, AC005291, AC003106, AB003151, AP000688, AC005386, AC005841, AL049576, AP000509, AC006261, AC000075, AC005885, AL034555, AL031670, AC004020, AF165926, AC006199, AL021917, AC007344, AC003101, AC004526, AC002544, AL109963, AF196970, AC005082, AL096791, D86995, AC002316, AC007283, AC007207, AC005664, AC003108, AC005369, AC002454, AC004820, L44140, U78027, Z97206, AL035422, AC003071, AC007556, AC006461, AC007537, AL031255, AL121653, AC004017, and AC002039.
HPDPQ40	639	922464	1 - 615	15 - 629		AI911379, AI382036, AI523065, AI567528, AA628532, AI359162, AI356788, AA483453, AA483438, AI811858, and T07668.
HPDQO05	640	929274	1 - 1104	15 - 1118		AI023890, AI744865, AI961389, AA694270, and AA778846.
HPDRB01	641	914437	1 - 540	15 - 554		AA508138, AI950798, AA013140, AA013366, and AL035594.
HPDRD28	642	957791	1 - 498	15 - 512		AI803130.
HPDRG92	643	967704	1 - 347	15 - 361		T96738, R90778, H47758, R94024, AA323896, N51812, and AB033116.
HPDRO20	644	957678	1 - 208	15 - 222		AI925316, C20550, and AW383499.
HPDVB07	645	951634	1 - 661	15 - 675		AL008628.
HPDVE05	646	928647	1 - 828	15 - 842		AA621983, AI738475, AI380189, AI380858, AI127232, AA622706, AW204003, AA621975, AI587036, AA665743, AI692234, AI249654, AI246971, AI246864, AW268783, AI692219, AI002242, AW137282, AW295910, AI308015, AI318288, AW301462, AI246934, AW268311, AI345591, AI246816, AI318117, AW301382, AI311495, AI610947, AI252418, AW086332, AI251546, AI792842, AI792856, AI345144, AW072879, AI313327, AJ223366, AI249650, and AI318575.
HPDVVF03	647	922193	1 - 834	15 - 848		AI183572, W03052, AI656704, AI916980, AA642326, AA337377, AA337144, and AA249832.
HPDVVK12	648	968977	1 - 560	15 - 574		AI148863, AI765291, N70646, AI914033, AI458020, AA551814, AI311395, and AW175659.
HPDVM06	649	933443	1 - 673	15 - 687		AI377852, AI283476, AA954783, AI914476, AI918738, AA371003, AW372827, AL119363, AI142137, AL119444, AL043011, AL119319, AI119304, AI134528, AL134518, AL119483,

HPDVY17	650	955902	1 - 432	15 - 446	AL119522, AL134538, AL119439, AL119484, AL119391, AL119496, AL042970, AL119396, U46346, AL043033, and AL031777.
HPEAF19	651	867892	1 - 291	15 - 305	
HPEBA06	652	960802	1 - 242	15 - 256	AA299493, AI580853, AA303099, AI287555, AA299492, AI279700, AA559290, N71724, AF177861, AW338869, AA493503, AA367546, AL031777, AC006130, U73024, AC009509, Y10196, U63721, AC006333, AC004047, AJ012197, AL139054, AL050333, AC006544, AC004527, and D87008.
HPEBA51	653	723298	1 - 423	15 - 437	N69328.
HPEBD31	654	655760	1 - 538	15 - 552	AA196263.
HPEBE44	655	716911	1 - 456	15 - 470	T72867, AA610577, and AC007695.
HPEKGI18	656	914115	1 - 84	15 - 98	AF111167.
HPEKJ42	657	922391	1 - 214	15 - 228	
HPEKU27	658	921663	1 - 428	15 - 442	
HPEKX12	659	969251	1 - 355	15 - 369	
HPFAA06	660	960801	1 - 429	15 - 443	AA737020, AW134485, AI874258, AI217712, AA935591, and AW389859.
HPFCA36	661	524720	1 - 275	15 - 289	AC004111.
HPFCA71	662	655596	1 - 351	15 - 365	AI798807, AC007065, AF073930, and AF064804.
HPFCF09	663	536666	1 - 343	15 - 357	AA617957, AI168322, AC005886, AC006071, AC006561, AL096791, AC004223, AC005670, AC002094, AC005156, AC002300, AC004815, AC007308, AP000212, AP000134, AP000030, AC006255, AC004685, AL132987, Z93017, AC002425, AL096701, L77570, AL021453, AC004890, AL049766, AP000555, Z83840, AC005089, AL049650, AC005756, AC008116, Z98941, AL034549, AL109952, Z98036, AL023575, AC002470, AL133445, AC007077, AL121658, AC005187, AC007279, AL080243, AC007546, AC006962, Z95113, AC005332, AC008372, AL031587, and AL035249.
HPFCF24	664	655744	1 - 398	15 - 412	
HPFCF40	665	968600	1 - 339	15 - 353	
HPFCF83	666	781490	1 - 329	15 - 343	AI749823, R99144, AA302658, AW161459, F24175, AI243793, AW161879, AI191343, AA130647, AI679221, AI003797, AA936548, W45457, H24953, AC005057, U62293, U63721, AC005829, AC005102, Z97630, AC005229, AL049830, AF111168, AL035658, AL132712, Z97054, AP000116, AC006241, AC000159, AC002300, AC005747, AB023051, AC009946, AC005323, AC006121, AL049692, AC003030, AC007536, AF047825, AL049757, AC004253, AC004520, AL109952, AC004030, AL023882, AP000512, U91321, AL022313, AF196779, AC020663, M55987, AC004893, Z75407, AF102137, AC003665, AC004033, AC002477, AF207550, AC012331, AC007666, AF064861, AL049548, Z84480, AC002107, AL030996, AL024507, AC006057, AC004841, AL078644, AC005480, AC002310, Z83838, AL022326,

HPFCH15	667	655768	1 - 344	15 - 358	AC005332, AF165926, AC006061, AC005529, U07561, AC008044, Z95114, X14448, AC004522, AL050307, U63834, AC005846, AL035086, AL022322, AC007226, AP000065, AC005755, AC005914, AC002115, AC005015, AC002073, AC005971, AL031311, AC002350, AC004876, AL022163, Z93930, AC005920, AL031295, AC005527, AC016831, AC005105, AC005081, AC004890, AC002351, AL049780, AC004560, AL020997, AC006449, AC006251, AC008012, AL034379, AC007055, AF001549, AC004475, AL035405, AC003682, AC006512, U80017, AC006480, AL035450, AC006285, AD000092, AL023803, AL080243, AD000671, AC005409, AC005274, AF001550, AC004129, AC002492, Z98950, AC005632, AC007263, U91326, AL034555, AC005839, AL031289, Z82203, AC002365, U91323, AL031659, AF045555, Z84469, AL022336, AF148808, AC005722, AL049869, AC006948, AC003041, AL022316, AC005184, AC007304, AC005874, AF134471, AP000502, AP000010, Z86090, AC005182, AC005479, AL031685, AL031393, U78027, AL021368, AC007207, AC004815, AC005363, AC002470, Z93017, AL021546, AP000553, Z99716, M63543, AC007917, Z95331, AL121754, AC002395, AC004884, AC005625, AC004859, L78810, AC007021, L44140, AC005399, AL021878, AL034553, AP000691, AL031230, AC006453, AC002316, AC004024, AC006211, AP000547, AC006515, AL049569, AC002106, and AL031591.
HPFCH89	668	655538	1 - 226	15 - 240	
HPFCM41	669	655736	1 - 356	15 - 370	
HPFCM87	670	923495	1 - 305	15 - 319	
HPFCN08	671	960365	1 - 363	15 - 377	AA651633.
HPFCO02	672	867871	1 - 263	15 - 277	W85782, AA703530, T99014, and C14044.
HPFCO67	673	867880	1 - 293	15 - 307	
HPFCQ88	674	655749	1 - 387	15 - 401	AI821958, AW150896, and AW205057.
HPFCR21	675	653621	1 - 452	15 - 466	
HPFCR82	676	655533	1 - 389	15 - 403	
HPFCT09	677	655563	1 - 311	15 - 325	
HPFCT53	678	974257	1 - 634	15 - 648	AI525556, AI546855, Z28355, AI526194, AI546999, AI525328, AI556967, AI525316, AI541374, Z30131, AA585356, C16300, AI525306, AI541508, AA585101, AI541523, AA585439, AI546945, AI546899, AI557799, AI541510, AI525431, AI557731, AI557082, AI541013, AI546875, AI557807, AI546828, AI541534, AI540967, AI526180, AI541307, AL134524, D61254, AI547039, AI541535, AI526140, AI541365, AI526184, AI536138, AI557262, T11028, AI540920, AI535660, AI557238, R29445, AI525653, D57491, AI525321, AI557796, AA585453, AI557787, AI547071, AI535813, AI526144, AL041197, AL040155, AL041346, AA585476, AL041096, AI047012, AL041358, AL041277, AL041163, AI041098, AL040621, AL043538, AL041324, AL040464, AL044162, AI041086, AL043496, AL041296,

AL041233, AI541415, AI541017, AI541514, AL045725, AL041140, T23985, AL040193, AI541205, AL043612, R28735, AL040149, AL039915, AI535639, C16305, AA585440, AL040463, AI546971, AI525320, AI557084, AL047219, AL041227, AL047057, AL047170, AL040119, AL047036, C15189, AL041292, AL041051, AL047183, AL040322, AL041131, AL046330, AL041133, AL041238, AL041142, AL045817, AL040529, AL040625, AL040510, AL043467, AL041186, AL040553, AL044037, AL040617, AL045684, AL040745, AL040370, AL043677, AL040285, AL040342, AL040332, AL040617, AL045684, AL040745, AL040370, AL043677, AL046442, AL041159, AL041246, AL040839, AL041752, AL043775, AL044165, AL043492, AL041602, AL043444, AL045920, AL038838, AL044074, AL041635, AL045990, AL040458, AL044199, AL044187, AL040253, AL040263, AL040090, AL040294, AL040329, AL040082, AL044272, AL041186, AL040444, AL040148, AL041730, AL041523, AL043627, AL043537, AL046392, AL041374, AL040052, AL041347, AL043845, AL044529, AL039338, AL042135, AL044064, AL039316, AL043923, AL038983, AL043814, AL043848, AI526196, AL040576, AL041459, R29177, AL043570, AL041577, AL044258, AL044201, AL046850, AL038532, AL040768, AL037727, AL045753, AL038761, AL040075, AL046994, AI526187, AL040414, AL040571, AL044274, AL046914, AL079878, AL049018, AI142134, AI557802, AL045857, AL041278, AL039744, R29218, T41289, AL038822, D55233, AL080031, AL046327, AL041168, AL045671, AL049069, AI557808, AL040472, AL041955, T18597, AL040238, AA585155, AI541075, AI546891, AJ239433, AL045989, AL039360, AI546810, AI541317, AL042096, AL079852, AL046147, AI540916, R45895, AI557727, AI541390, AI526073, AI525856, AL044125, AI174170, AI541345, D61185, AI557734, AI547006, AI557740, AL039643, AA585434, AI557279, Z32822, R28967, D57186, AI541517, AI525339, AR038762, X81969, I13349, AR017907, A25909, A91965, AR062871, I66485, AR038855, I66487, A85395, A85476, I18895, AR008429, AJ244004, AR037157, AJ244005, AC005913, AR062872, AR062873, AJ244003, AF082186, U94592, A20702, A20700, A43189, A43188, AJ244007, I63120, A98767, A93963, A93964, A98420, A98423, A98436, A98417, A98427, I44681, X83865, A84772, D78345, A84776, A84773, A84775, A84774, Y16359, AR054109, AR067731, I15717, I15718, Y09813, AR067732, A86792, A58522, A91750, I08396, M28262, I08395, A60212, A60209, A60210, A60211, E03627, A18053, I48927, I06859, I84553, I84554, I00682, A02712, I49890, A77094, A77095, A81878, A35536, A35537, A11623, A11624, E00609, A95051, A02135, A04663, A02136, A04664, A18050, A23334, A75888, I70384, A64973, A60111, A23633, E13740, AR007512, A11178, E01007, A10361, Z32836, I62368, A11245, A93016, AR043601, I03331, A02710, E12615, AR035193, AF149828, E14304, A07700, A13392, A13393, AR031488, I13521, I52048, A27396, D50010, AR027100, I44531, I28266, A90655, I21869, A92133, I44516, A70040, AR031566, E16678, A82653, E16636, A95117, AR038066, A24783, A24782, A58524, I01995, A58523, I25027, I08051, I26929,

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HPFCT62	679	655432	1 - 310	15 - 324	AA487150, AA486829, AA347969, AA622801, AL078409, AA602906, AA084609, AL078621, Z96201, AC005484, AF064861, AC004862, AL021393, AP000501, Z97056, AC005244, AL049569, AC005225, AC005318, AC007371, AC002477, AL035443, AF111168, AC004821, AC005104, AL133448, AC006388, AC005839, AL035249, AL022336, AF196969, AC004448, AC009247, AC005562, AC005058, AL079305, Z98051, AL132985, AC005261, AC005089, AC002350, AP000116, AC003102, AC005071, AL050318, AC004525, AC005332, AC006449, AF001550, AC005409, AC004967, AC006312, AC005924, AP001052, AC005519, AC005920, AC010205, Z83838, AC004685, AC005231, AC004814, AC004878, AC005081, AL109627, AC004983, AF130248, AC006946, AL034429, Z86090, AL031984, AC004851, AL109627, AC003663, AL031286, AL049636, AB023049, AL008720, AC004584, AL109798, AC005880, AC002527, AP000553, AL033527, AC004253, AL034420, AC006441, AC000353, AC002303, AC004678, AL008726, AP000692, AL133246, AC004905, AC005015, AC005037, AC002551, AC005088, AL049780, AC002094, AL031587, AL031282, AC004531, AC004655, AL035691, AL024498, AL035458, AC006965, Z95152, AL022238, AP000689, AC004811, AL049539, AC005479, AF001549, and AC002400.
HPFCV19	680	655706	1 - 302	15 - 316	AI279012.
HPFCV71	681	525554	1 - 536	15 - 550	R31337, AW028647, and AF178081.
HPFCX18	682	655588	1 - 325	15 - 339	
HPFDD06	683	960700	1 - 291	15 - 305	AI557495, and AI557116.
HPFDE38	684	655704	1 - 343	15 - 357	AI417952.
HPFDE61	685	974249	1 - 681	15 - 695	
HPFDF79	686	973732	1 - 576	15 - 590	

HPFDG58	687	655610	1 - 310	15 - 324	
HPFDI23	688	655549	1 - 355	15 - 369	
HPFDL90	689	954333	1 - 193	15 - 207	U73330.
HPFDS59	690	655543	1 - 267	15 - 281	AC004111.
HPFDT17	691	581133	1 - 359	15 - 373	
HPFDT54	692	655530	1 - 310	15 - 324	AA593648.
HPFDT61	693	974569	1 - 345	15 - 359	
HPFDU30	694	522113	1 - 357	15 - 371	AL079301, and AC004530.
HPFDU38	695	867879	1 - 365	15 - 379	
HPFDU59	696	739617	1 - 357	15 - 371	AC005225, AL049835, and AL031297.
HPFDV71	697	867870	1 - 680	15 - 694	AW303098, AI061313, AI251203, AI251284, AI250552, AL046519, AI284543, T74524, AI223626, H07953, AI206841, AI254770, AI189682, AW023111, AI826761, AI357823, AI251034, AI249853, AA572813, AI375542, AI755202, AI066646, AW410409, AA129746, AI732430, AA757661, AW276678, AI679759, AW149288, AI635819, AI355007, AW439703, AI491765, AI753113, AW237905, AI149537, AA702637, AI864500, AI334443, AW192179, AL038936, AA904211, AI587583, AA614214, AI247101, AL031730, AC002316, AL031311, AL022328, AC007055, AL022326, AC006965, AL109865, AF109907, AC005081, AL034343, AC005592, AL133485, AL049538, AL022238, AC005355, AC005011, AC007358, AC005291, AL049540, AC008123, AP000688, AC004491, AL080243, AC008372, AL133445, AC003043, AC004685, AC005874, AF134471, AP000501, AF111167, Z83844, AC004675, AL049780, AF088219, AC006552, AJ011930, AC007277, AC005330, AC007243, AC006046, AC004686, AC005363, AC005209, AC005231, AC005746, Z97056, AL135960, AJ131016, AC004883, AC005619, AC005189, AC002430, AP000511, AL033821, AC006213, AF134726, AC007384, AC006130, U91326, AC002544, AC004084, AC004067, AL121603, AC005519, AC005899, AC004821, AF031078, AC008064, AJ010770, AC002369, AF030876, AC009731, AC005844, AC009510, AL031228, AC005406, AL079352, AC005884, AL022721, AL022476, AL049795, AC004879, AC005821, AL049760, AC005234, AC004593, AC007129, AC016830, AP000031, AL023284, X55927, AC006960, AC006203, AC005911, AF001548, AC010202, AC005368, U07563, AC004542, AL096701, AC006241, Z98750, AC005015, AC004656, AF015416, AF001549, Z82171, AC002350, AP000134, AP000012, AP000030, U91325, AC007385, D84401, AC002404, AC007637, AC006511, AC006480, AL031803, AC005606, AC002347, AC000115, AC005829, AF031076, AL031281, AF053356, AC004051, AL096791, AC005072, AL049758, AL133353, AC005565, AC016027, AC003101, AC005531, AC004990, AF001552, AL121652, AC004517, AL117351, AC007011, AC004033, U95742, AC003109, Z70280, Z83845, AC004147, AC007216, AC004805, AC006079, Z84470, AC005747, AC005225, AB023048, AC005099, AC005500, AC004526, AC005701, D87675, AC004841, AC005722,

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HPFDX13	698	655571	1 - 641	15 - 655		W67821, AI934358, AW183528, N55430, AW008575, W67636, AA825800, and N55148.
HPFDZ20	699	655764	1 - 328	15 - 342		
HPFEA08	700	960372	1 - 386	15 - 400		
HPFEA32	701	925499	1 - 295	15 - 309		Z82203.
HPFMA06	702	953536	1 - 213	15 - 227		AI559365, N40914, AI275689, AI769835, AI935795, AW016872, AA528426, N90231, AI041472, AI074180, AI151237, N40445, AI016719, AI352160, AA828194, H09741, AI982675, AI628382, AI912707, AA918026, N35976, AA460976, AI742265, AA151707, AI191783, AA165615, W74067, AI167928, AA937011, AA724886, R01930, AI863504, AI346991, AI309905, AA992772, AA946858, AI521733, AA055546, AA829079, AI867798, AI636334, AI636278, AA101634, AA992190, AI573041, AA044901, AA128910, N94816, AA708943, AA609789, AA041398, AI056570, AI539174, AI571014, AI318378, AA443890, AI609286, AW235575, AI768743, AA903691, AW028229, AI773169, AI337984, AW273159, AI571376, N33273, AI498347, AW103657, AI824744, H97981, AI433353, AI250273, AI189253, W74059, AI277240, AI200413, AA024491, AW262540, AI767595, AI269009, AI805098, N69196, AI768580, AI689518, AA570675, AA374175, W37740, AA594795, AW088741, AW197140, AA165407, AA165437, AA604629, AI744021, AA780710, AA581888, AA722100, N66617, N30750, N25542, N26634, D61746, AI364247, AI363458, AI719503, Z39345, AA165599, H89567, F04672, AI708771, N91853, AI654339, AI719808, F10645, N71113, AA044690, AI695775, D51138, H89566, AI828511, AI423935, D19831, AI364605, R38667, AA461285, D51197, AI913698, T62947, D62512, AA063398, AI766125, T31394, AL133241, AL009179, and AC008126.
HPFML02	703	917775	1 - 102	15 - 116		AI535639, Z33559, Z32887, T18597, AI541356, CI4228, D59751, AI557864, D50992, AI526078, AI557084, AI541205, AI536138, AA492147, AI535660, AI557262, AI540903, AI557082, AI557474, AI525302, AI525500, AI525556, AI557533, AA058620, AI557317, AI525316, AI557809, AI541075, AI557155, H65400, AI541321, AI541365, AI525757, AI557312, AI557602, AI557731, AI525852, AI525661, AI541353, AI541034, R29657, AI525856, AI557258, N71206, AI536150, AI557810, AI541450, AI541346, AI557238,

HPIAE79	704	655748	1 - 382			AI540974, AI546829, D30843, AI535828, AI557543, AI535813, AI536070, AI535994, AI557039, AI541154, AI547177, AI557041, AI557408, AI541027, AI541048, AI557154, U45328, AR050070, A62300, A62298, A82595, A82593, U94592, Z30183, AF006072, and AR025466.
HPIAO83	705	655595	1 - 413		15 - 396	
HPIAQ49	706	919469	1 - 424		15 - 427	
HPIAQ76	707	655573	1 - 47		15 - 438	
HPIAS40	708	928614	1 - 450		15 - 61	
					15 - 464	AA195825, AA306492, AA418582, C16647, AW160459, AA309024, AA308183, AI571333, AA738174, AA195976, AI570688, AA612815, AA995713, AA418567, AI376546, AA977055, AW162470, AA575997, AA083678, AA100585, R35954, AA643289, AI566298, AI094772, F00910, AI282111, AA492519, AI564065, AA676682, AA622171, AA378734, R35925, AA884373, AI138493, AA156573, AA111863, AI305825, AA553893, AI557187, AA618507, AA469352, AA159175, AI266155, AA469274, N74960, AA412547, W05658, N39508, AA658912, AA083301, AA328913, F26029, AF088991, AF044954, AF067169, AC005363, AC005606, X63224, AF088992, and AF088993.
HPIAV80	709	615007	1 - 211		15 - 225	
HPIAX11	710	925424	1 - 596		15 - 610	AA312500, AA354863, AA319616, T69203, AA491370, H16422, AW403746, and AL031427.
HPIAZ37	711	655753	1 - 300		15 - 314	
HPIBQ37	712	884289	1 - 411		15 - 425	AA101561, W76302, C17760, AA227408, AA215609, AA101519, AA626769, AA359412, T73746, AI927392, AF111713, A91701, A91699, AF207907, AF172398, AF154005, and AB017568.
HPIBR51	713	725539	1 - 454		15 - 468	
HPIBT49	714	655719	1 - 426		15 - 440	
HPIBY65	715	655757	1 - 421		15 - 435	
HPICC89	716	786117	1 - 400		15 - 414	R43644, AA953944, and AL035454.
HPIAB19	717	655540	1 - 191		15 - 205	AA741301, AA331014, AA461592, AI300413, AI342786, H42893, AI302277, AW407007, AI018726, AW157173, AW162314, AW162332, AW168699, R71796, AA657910, AI818313, AA429481, AA633068, AW082076, AL041733, AI471455, AI687343, AI473671, AI963816, H86579, AA225239, H30595, H30568, AA018923, AA012829, AI290145, AI459866, AA643451, AL037006, F35902, AI679759, AW392414, AA084595, AI474085, AI476386, AI925462, AI440243, AA092862, W45457, AI951112, AI620045, AI183426, AA225630, AI167360, H99222, N21300, AA992562, AW190925, AI936229, AW080772, AA829669, AI376239, AI017733, AL039117, AA381880, AW105346, AA112864, CI4599, F26285, AA587536, H27788, AA904211, AA827383, AW019964, AW262466, AI799260, AI860535, AA460880, AA643441, AI962050, AI917271, AA604149, AI358557, AI032411, AI131261,

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HPJAB84	718	655531	1 - 314	15 - 328	
HPJAC36	719	655601	1 - 401	15 - 415	
HPJAC92	720	867831	1 - 338	15 - 352	

HPJAD09	721	655712	1 - 329	15 - 343	AL080239.
HPJAD66	722	655694	1 - 276	15 - 290	Z83851.
HPJAD82	723	655765	1 - 237	15 - 251	AI979243, and AI967993.
HPJAV07	724	952852	1 - 321	15 - 335	
HPJAW56	725	823393	1 - 757	15 - 771	T93943, T93893, AA399372, and T81024.
HPJB117	726	655761	1 - 417	15 - 431	
HPJB189	727	655708	1 - 69	15 - 83	AC006071.
HPJBK52	728	655751	1 - 249	15 - 263	AW275406, and AC000378.
HPJBU08	729	958979	1 - 351	15 - 365	
HPJBV17	730	655729	1 - 286	15 - 300	
HPJCC04	731	926787	1 - 357	15 - 371	AF108195, AF159714, AF186379, AF106698, AB025784, and AF049330.
HPJCP10	732	964259	1 - 421	15 - 435	
HPJCP11	733	966676	1 - 325	15 - 339	T08031, and AB011095.
HPJCS84	734	590404	1 - 333	15 - 347	AP000494.
HPJCV50	735	968095	1 - 535	15 - 549	AC005923.
HPJCX15	736	655730	1 - 320	15 - 334	
HPJCX26	737	655600	1 - 337	15 - 351	
HPJCY70	738	655569	1 - 218	15 - 232	
HPJCZ03	739	922850	1 - 171	15 - 185	
HPJCZ06	740	934170	1 - 278	15 - 292	AI133297, AW163293, AW303196, AA191659, AW080777, AW084466, AI499588, AA279421, AA548890, AA431949, AA486131, AW301350, AA457070, H71429, AI040342, AW275510, H52274, AL133909, H82316, AI250083, AA661921, AW102846, AL042420, AI953275, AA476397, AI766906, M77893, AA630672, AI205010, AI284640, AL038498, CI8550, AA320966, AA579179, AI393931, AA114983, AA774780, AL119713, AI002720, AW274349, AA508359, AI818231, AI271164, AA838190, AI806102, AA577824, AA385798, AI708009, AA578327, AI889566, AA832188, AI499301, AI801482, AI298061, T92347, AW103927, AA984295, AA558884, AA055871, AI733755, AA584876, AA504877, AA127426, AA669155, H09071, AI805363, AI203925, N23504, AA101689, AW104793, AI168167, AI694130, AA572971, AI950983, AI056913, AI345157, AI924872, AW316873, AI046689, AA653857, AA323701, AA772851, AA526787, AA778992, R64559, R95448, AA490183, H49568, AW022897, AA402129, AA493695, AA834707, AA738253, AA719073, T99179, AL035209, AL035450, AC000119, AC002529, AI133371, AC002310, AC007446, AC007845, AC002127, AJ003147, AC007652, AL031053, AC005215, AC003100, AC004638, AC006314, AL033523, AC002416, AC006466, AC006112, AC006312, AC005998, AC004745, U57009, AL049773, AL049733, AC006989, AC012599, AL035608, X53548, AC004161, X54175, D83989,

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HPJDA08	741	958182	1 - 1026	15 - 1040	AJ003623, and AB033053.
HPJDJ58	742	906904	1 - 557	15 - 571	
HPJDP05	743	931027	1 - 607	15 - 621	
HPJDX94	744	838748	1 - 237	15 - 251	
HPJEE38	745	954970	1 - 778	15 - 792	AI371073, AI219866, AA994007, AI624792, AA455079, AA731668, and AI357531.
HPJEI55	746	926815	1 - 218	15 - 232	
HPJEJ39	747	930988	1 - 534	15 - 548	AL121576.
HPJEQ04	748	927618	1 - 353	15 - 367	N31776, D81937, AA308517, W24026, AA188787, T85662, AA486505, AA296183, AA371449, AA480085, H68032, AI905771, N24360, AI557456, AA378402, N44103, AJ230778, N36604,

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HPJEQ22	749	867725	1 - 629	15 - 643		T03269, D58283, D80022, D80195, D80193, D59927, D51423, D59619, D80210, D51799, D80391, D80240, D81030, D80253, D80227, D80196, D80188, D59275, D80219, D80366, D80043, D80038, D59859, D80166, D80212, A1905856, D80269, D50995, D59889, C14429, D50979, D80134, D80378, D80024, D80045, C75259, AW178893, C14014, D59502, D57483, D59787, D59610, D51097, D80164, D80241, F13647, D80268, C14331, D51060, AW177440, D58253, C15076, D59467, D80949, D80168, C14227, AA305409, AW378532, AW178775, AW179328, C14389, AW352117, AW352158, AW177501, AW177511, D51079, AW178762, D51022, AW366296, AW360811, AW176467, AW375405, AA305578, AW377671, D59695, AW179220, AW360844, AW360817, D81026, AW375406, D80248, AW378534, AW179332, AW377672, AW179023, AW178905, AA514188, D52291, D80251, D80132, AW352170, AW352171, D80522, AW377676, AW177731, AW178907, AW179019, AW179024, AA514186, D80133, AW178906, AW177505, AW179020, AW178909, AW177456, AW179329, AW178980, AW177733, AW378528, AW178908, AW178754, AW179018, AW179004, AW178914, AW178911, AW367967, AA033512, AW352174, D80302, AW178774, AW177723, D80439, D80247, T48593, AW178983, D51103, A1535850, AW367950, C14975, AW178986, D45260, A67220, A62300, A62298, D34614, D26022, X67155, A25909, A84916, D89785, A78862, AR025207, D88547, A132110, AB012117, Y17188, A85396, AR066482, X82626, A85477, A86792, X93549, I19525, A44171, AR018138, X68127, A135125, U87250, AF058696, AR008278, Y12724, AB028859, AR064240, A94995, D88507, AR008443, AB033111, I18367, I50126, I50132, I50128, I50133, AR066488, A82595, AR066490, AR016514, D50010, D13509, AR060138, A45456, A26615, AR052274, Y09669, AR060385, AB002449, AR066487, A43192, Z32749, A43190, AR038669, A30438, AR008408, U87247,
HPJET90	750	836503	1 - 542	15 - 556		

HPJEV06	751	934096	1 - 504	15 - 518	U79457, AB023656, AR060133, X93535, and AR008382.
HPLAN47	752	717680	1 - 488	15 - 502	R77414, R76671, R69252, R76677, R32705, R68709, R62204, H68658, R66563, R69804, H79604, R79061, R28309, H78098, R80677, H13421, H12467, R28193, R26740, R63675, R79115, R28382, R26685, R71045, R80483, A1147439, AA367784, R67876, R75656, R62719, N45236, A1685384, AW074013, A1744897, A1682985, A1830819, A1051767, AW298380, AA429290, A1672705, R79114, H28769, A1961748, A1719461, AA411112, AA292246, AA411111, AA565430, R32518, H03930, AA428704, AA235525, A1244500, AA367885, AW081078, R94826, AW135966, R69938, H13465, H78097, R24254, A1962580, A1656685, R63981, T95910, R76350, R23579, A1765947, R81427, R22392, AA236697, A1096455, T24700, AA430655, R28308, AA564171, R23234, AA811964, AA177137, AA483918, H68983, H00975, R32651, H12520, R28594, AA806843, AA292545, R25221, AA744128, AA640543, AA427477, H79603, AA320868, R77413, AA377663, AA525377, H90432, H03929, R69134, H70222, R26973, AA329358, T35477, T31730, T34672, D81451, T19025, AA143133, AA902113, H08404, H08284, R52419, AA902115, R35278, R59021, R36040, Z43118, AF085838, AC005281, AP000884, D28589, AC007114, and AL110197.
HPLAR41	753	557554	1 - 278	15 - 292	AA367867, AA367898, D58066, AA385928, AA610791, A1803229, A1004961, AA298314, AW157413, A1291353, F35348, AL041411, AA663300, AA132536, A1990650, AW139132, N94967, A1290861, A1961193, AA584498, AA657353, AA081993, H96719, A1025602, AA501873, C17730, AA911409, H04879, AA055654, A1250812, A1921101, A1925647, A1559442, A1955464, AA508451, AA946637, A1632138, AW102963, A1568919, AA659014, A1872191, AA862481, A1869945, A1871616, A1538654, A1902795, W45291, W58428, AA166854, AA629837, AA460715, AA092309, AA287329, A1952804, AA176355, AA130476, A1817158, AA767353, A1285660, F16040, AA932087, A1246569, AW262471, N77920, A1862212, AA811111, A1819528, AA864823, A1601265, A1858607, R33901, A1524900, AA771730, AA771711, A1336355, F33397, AA347740, A1421777, N79992, A1499286, A1440018, AW272376, A1453790, N31608, N3132, N20064, A1375417, A1540098, N30146, A1310239, AA364962, A1591332, AA132716, A1628308, N90055, W19865, AA830701, AA129986, AL044349, A1271865, A1457328, A1027421, AA807609, AW085676, A1376984, AL038713, AL119517, AA136576, A1095849, A1082077, N24958, AA961590, H06476, AA779937, A1028382, AA309496, AA091111, A1827493, H01157, AW419031, AA492106, A1088245, AW272291, T48029, AW072619, AA136630, AA099788, A1733728, AL034400, AF030186, AC005350, AL031294, AB020871, AC005852, AC005688, AC006363, Z95328, AC004910, AC002448, AL022151, AF064862, AC004081, AL137191, AC007262, AC004384, AL133233, AL049871, AC006559, AL136504, AP000079, AC006989, AC002524, AC007444, AF002997, AC001604, AC001157, AC005579, AL023582, AC008165, AC006525, A1.021307,

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HPLBB50	754	503751	1 - 292	15 - 306	AA368037, and AA368044.
HPLBL31	755	503732	1 - 349	15 - 363	AA368423, and AA368422.
HPLBL57	756	503730	1 - 261	15 - 275	AA303008, AA303009, and AC002427.
HPLBO61	757	558187	1 - 229	15 - 243	AA368593, AA758725, and D86985.
HPMAG19	758	705471	1 - 290	15 - 304	AA369206, AA369215, AW276918, AL498304, AL859717, AL635381, AL873828, AL806367, AA992384, AL651551, AL073771, N26890, AL479551, AA287708, AL628336, N21211, AL942382, AA553615, AA479887, AW085308, AW137286, AA873472, AA679635, AA586824, AA708432, and AB023229.
HPMAH75	759	766443	1 - 301	15 - 315	AA303039, AA369332, AA335519, AA553332, AA745302, N63749, Z95331, AC003682.

HPMBK34	760	954057	1 - 374	15 - 388	<p>AL022327, AC005488, AL035685, AL031587, AC004856, AC005015, AC005899, AL109628, Z98884, AL035684, AL031589, AC003030, AL133245, AC007842, AC007685, AC005231, AL133163, AL049759, AC005788, AL109801, AL031283, AC005412, AL049874, and AC002349.</p> <p>AA662989, AA668148, AA513884, AI912401, AA303131, AA077247, AA654482, AA493618, AL038527, AI872000, AW105463, AA515351, AA744423, AI590404, F26713, R49880, AW273146, AW273201, AA309232, AI439393, AI926656, H43771, AA631515, AA569715, AI929796, AI798407, AW194077, AA758131, AW157731, AA488903, AW162750, AW003612, AC005940, AC007240, AC005519, Z83840, AC006455, AC005899, AC005482, AL022322, AP000555, Z83822, Z83844, AC007358, AL031255, AC005280, AP000347, AL022313, AC005722, Z98051, AL035415, AL121653, AC005300, AC004084, AC007193, U95742, AL049709, U95739, AL049835, AC007216, AL022329, AL034419, AC002301, AF111169, AC005412, AC004878, Z83843, AC004253, AC000353, AC002477, AC003026, AC005207, AC007435, AF027390, AL008725, AC010205, AC004991, AC008116, AC005829, AP000694, AC005409, AC002425, AP000512, AC006011, AL135744, AL031588, AC005971, AC005529, AC007227, AL031651, AE000658, AC004887, AC002544, AC007308, AF001548, AP000553, AC004019, AP000008, AP000501, AC002300, Z83820, AC004386, AC005015, AB023049, AC004491, AP000704, AC005086, AC004702, AC006372, AC002351, AC002059, AL050318, AC006126, AL132777, Z95114, AF109907, AC005332, AC009247, U95740, AC005102, AC008115, AC004805, AC006285, AC007731, AC006039, AC005839, AC016830, AC006459, AF196970, AC006509, AB023048, AL022238, AP001063, AC006468, AC002470, Z98036, AL008718, AC005088, AC005527, AC006449, AD000092, AC007421, AC007649, AC005484, U47924, AL109758, AL035249, AL139054, Z95113, AF196779, AC006057, AC004517, AC005072, AC005859, AC008012, AL022237, AC007073, AL049552, AC005696, AP000503, AC005089, AF107885, AC005500, AP000692, AC004876, AC005411, AL035587, AC005803, AC005520, AL023575, AC004263, AL022323, AP000504, AC006992, AF029308, AC000052, AC007880, AL133163, AJ003147, AC005746, AC006111, AC007387, AC007276, AC005695, AC008125, AF129756, AC007226, AC004938, Z83838, Z93017, AL035419, AC007011, AC004169, AC005355, AC004382, AL035659, AC005377, AF196972, AL031282, AC008015, AL049697, AP000689, AL031577, AL031291, AC005914, AP000123, AP000055, AP000170, AC005049, AC006120, AF134726, AC003101, AC005005, U52112, AL022316, AC005225, AC007934, Z97054, Z82189, AP000510, AC002094, AC005261, AC007546, AL031123, AC004686, AC007685, AL034548, AC004801, AC003043, AL023513, AC005895, AL117258, AL035684, AL031295, U73024, AC005516, AC004583, Z97055, AC002418, AL031311, AP000346, AC003663, AC004813, AC002400, AC006515, AC007450, AC005383, AC002992, AL121655, AD000084, U91321, AB003151, AC006441, AC006241, AL024509, AC005486,</p>
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HPMBK49	761	577661	1-416	15-430	AL035405, AL035691, Z85996, and AL031650.
HPMBM48	762	575626	1-489	15-503	AA253119, and AA256187.
HPMBN02	763	920865	1-106	15-120	AL031848.
HPMBO10	764	968365	1-349	15-363	
HPMBO61	765	867677	1-431	15-445	AL133650.
HPMBR17	766	785732	1-415	15-429	
HPMBU81	767	557870	1-470	15-484	
HPMBX35	768	531058	1-195	15-209	
HPMBX79	769	577637	1-372	15-386	
HPMBY76	770	531338	1-332	15-346	
HPMBY83	771	527006	1-428	15-442	AI590323, AW379794, and AW379800.
HPMBZ05	772	932527	1-211	15-225	
HPMCB65	773	531289	1-403	15-417	T47761.
HPMCC73	774	531066	1-301	15-315	
HPMCD77	775	529960	1-266	15-280	AI141166, AL040565, and AP000495.
HPMCI02	776	381961	1-416	15-430	R53558, AW183662, AI936591, AI554166, Z39384, and AI658791.
HPMCI65	777	577598	1-275	15-289	
HPMCJ14	778	524768	1-393	15-407	
HPMCJ19	779	531279	1-241	15-255	AC000105, AL031591, and AC004032.
HPMCJ48	780	577601	1-291	15-305	
HPMCK65	781	742095	1-319	15-333	H64820, AA092052, and AL023807.
HPMCS19	782	954056	1-195	15-209	AW136091, and AL031710.
HPMCS65	783	961250	1-120	15-134	AC005923.
HPMCV93	784	657532	1-429	15-443	AA128929, R11967, T78064, AA449505, T74763, and AB018281.
HPMCW25	785	867673	1-630	15-644	AA429660, AI375673, AI656667, AA320869, and AI222277.
HPMCW53	786	727392	1-190	15-204	
HPMCX11	787	967655	1-300	15-314	AW029019.
HPMCY30	788	867687	1-344	15-358	
HPMCY31	789	725180	1-325	15-339	AA113940.
HPMCY35	790	571411	1-637	15-651	T95994, and AW440904.
HPMDJ09	791	582594	1-290	15-304	
HPMDL78	792	577590	1-340	15-354	AF111168.
HPMDO39	793	531275	1-192	15-206	
HPMDR07	794	867682	1-285	15-299	

HPMDT91	795	745346	1 - 334	15 - 348	
HPMDU19	796	577626	1 - 313	15 - 327	N69438, N71427, N62439, H80350, R83031, H66851, H67489, R62741, AA918030, H54212, and AC005281.
HPMDY82	797	531274	1 - 39	15 - 53	
HPMDZ62	798	531276	1 - 360	15 - 374	
HPMEB66	799	531349	1 - 397	15 - 411	AC006500.
HPMEC16	800	867658	1 - 299	15 - 313	
HPMEC36	801	668897	1 - 333	15 - 347	
HPMEC69	802	702501	1 - 270	15 - 284	N20192, and AC008123.
HPMED52	803	531347	1 - 438	15 - 452	AI906494, and AC005004.
HPMEE48	804	531321	1 - 428	15 - 442	AC007966.
HPMEE66	805	577619	1 - 323	15 - 337	
HPMEG50	806	925080	1 - 140	15 - 154	
HPMEI39	807	784781	1 - 704	15 - 718	
HPMFB02	808	920308	1 - 391	15 - 405	AA029876, AA029112, AI089387, W80831, H23039, AA314213, AA209372, AA209368, H55702, AA304885, AI218927, AI021707, AL050345, AJ236698, AL080313, and AC006441.
HPMFB28	809	575934	1 - 327	15 - 341	AW197446, AI972578, AI657152, AW204366, AA436769, AA442937, AI261197, AA421160, AA034360, and AI675734.
HPMFB37	810	575620	1 - 648	15 - 662	
HPMFB75	811	526594	1 - 220	15 - 234	T58945, T58884, and AI352293. F19258, AW419161, AW438916, AI205126, AA077817, AI565245, F35659, AA318652, AA551509, N87410, W60516, AA515938, AW029038, AA025083, AI252554, AA743956, AI285615, AA618158, AA932099, AW275674, AW236342, AI679045, AI446601, AA177061, F29989, AL133862, AI200051, AI469641, AA631363, AL041368, AA327782, AA626637, H04821, AA745410, AI873916, AL040130, AW440976, AA501600, AI049634, AW008317, AW338500, AA441788, AW069227, AL040913, AI824562, AI633007, AA503454, AA602069, AA228420, AW207652, AI962050, AI358229, AA557879, F36373, AW16815, AW406755, AI985519, AI634187, AI365988, AA713815, AA610786, AI917271, AI457313, AL048925, AI251002, F32705, AI003743, AL042213, AI918421, AW129262, AA886584, AA484059, AL040072, AA515051, AW339687, AI246796, AI929531, H65428, AI291124, AI151261, AA515224, AA340960, AI904894, AL120008, AI499094, AW419118, AI635272, AA229785, AI291268, AI802526, AW069807, AA559290, AI521679, AI537030, AI890923, AI922002, AW162049, AW080134, AI474713, AI433187, AA501722, AI608626, H69041, AA469451, AI049722, U02048, AP000158, S75337, AL035555, Z72521, AF015162, AL031670, AC004057, A39972, U14701, AF140763, AL121603, AF017257, U14684, U14691, U14685, U14686, U14687, U14688, U14689, U14692, U14699, U14702, U14707, U14710, S75201, U14711, U14712, U14713, AP000014, U14714, U14715, AL020997, U14716, AP000692, U14717.

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HPMFB84	812	577593	1 - 347	15 - 361	AA917042, AA476820, AA861762, AW197737, AA883969, AI222281, AI394043, AI476496, AI420953, AI816942, AW418714, AI337319, AI312584, AI268413, W60319, H72483, AI125256, AI198189, AI739036, Z57770, Z59847, and Z57771.
HPMFE35	813	577633	1 - 415	15 - 429	AC005909.
HPMFE60	814	577636	1 - 309	15 - 323	
HPMFE73	815	575941	1 - 416	15 - 430	AL009031, and AC002326.
HPMFH21	816	575943	1 - 447	15 - 461	
HPMFI50	817	575932	1 - 475	15 - 489	R20682, T65200, Z44442, and F11983.
HPMFI55	818	577588	1 - 369	15 - 383	
HPMFL08	819	959569	1 - 452	15 - 466	AA555286, AA640814, AI281916, AW073979, AI378363, R70468, AW242350, AW013856, AA644290, AW449140, Z93016, AC012384, AI035541, AC005228, AC003662, and AC009300.
HPMFL80	820	874359	1 - 440	15 - 454	AA313895, AA834888, AA362291, AW366931, AA436945, AA496034, AI834310, AA402490, AI039687, and AC004841.

HPMF29	821	582595	1 - 860	15 - 874	AA255639, R53909, AI492887, H09275, AW192355, N48929, and AL117598.
HPMFN12	822	968821	1 - 499	15 - 513	
HPMFP05	823	867662	1 - 413	15 - 427	
HPMFP30	824	577629	1 - 335	15 - 349	AC008072.
HPMFP38	825	575914	1 - 342	15 - 356	AC006121.
HPMFQ84	826	867651	1 - 678	15 - 692	R31294, AI823535, AI823533, AL038977, AW271095, AI252141, AL135383, AI792856, AA594742, AW302832, AA828911, AI284536, AI251563, AI733946, AA578905, AI383596, AI733930, AL047645, AI792695, AI792746, AI792842, AI252190, AI281401, AI689198, TS6025, AA553900, AA557493, AA809125, AA484022, AA219181, AI859906, AI089178, AA551067, AI884861, AA169245, AA494047, H81918, AI798313, AI298660, AI038324, AI798569, AI869786, AW269071, AI347649, AI347478, AI761677, AA599080, AC006060, AL022318, AF111168, AL049779, AL034420, X14448, AL021978, AC007731, AC005500, AJ010598, AC000071, U78027, AC015853, AC005932, AC004033, AF001549, AL035422, AC006312, AC004263, AC004000, AC005037, AC005412, AL008715, AC005006, AC006057, AC002544, AC006088, AL133243, AL009051, AL031255, AC005828, Z85996, AC004771, AC006946, AC004527, AL031577, AC005071, AC004675, AC002470, AC002045, AC002390, AC009263, AL135744, AC004821, AC002300, AC005295, AC005952, AL022316, M26434, AF088219, AL035634, Z98941, Z97053, AC005527, AC005048, AC002106, AC007050, AC008124, AC004262, AC005363, AF015416, AC005730, AC007686, AJ006216, AB017602, AJ246003, AL031133, AF172277, AP000248, AP000704, AL096702, Z81364, AC004912, AL020997, Z83844, AB020868, AL110121, AC006023, AL035681, AL080243, AL008721, AL132987, AL121658, AL049745, AC005368, Z98742, Z85987, AL021391, AC007227, AF196972, AC000025, AL031428, AL132642, AC005520, AC005041, AL049692, AL031673, U95742, AL049776, AP000555, AL031846, AL049694, AC004143, AC002115, AC004531, AC006480, AL033517, AL132777, AC004491, AC005829, AC005529, L44140, L78810, AC004797, AL035398, AP000692, AC004941, AC007676, AC006064, AC006356, AC002509, AL022719, AL008718, AL020993, U52112, AC007676, AC004223, AC002477, AC004805, AP000326, Z84466, AP000047, AP000226, AF134726, AC004223, AC002394, AC009464, AP000301, Y07950, AC008372, AC003689, AF030453, AC007151, AC002394, AC002394, AC009464, AP000301, Y07950, AC008372, AC007566, AC004887, AL031602, AC004841, AC004150, AP000054, AP000169, AP000122, AC004812, AL049569, AC005326, AL109984, AC005323, AL031228, AC004983, AL035416, AF109907, AP000049, AC005800, AP000115, AL031311, AP000311, AC006241, AC004383, U85195, AL023876, AP000131, AP000209, AC007435, AP000087, AC005229, AL031433, Z98304, AC005088, and Z85986.
HPMFS41	827	711640	1 - 422	15 - 436	Z95331.
HPMFT04	828	916662	1 - 316	15 - 330	

HPMFU89	829	575894	1 - 326	15 - 340	
HPMFV28	830	652097	1 - 330	15 - 344	AA434145, A1422195, and AC007239.
HPMFV82	831	575911	1 - 363	15 - 377	AL120663.
HPMFV88	832	956263	1 - 353	15 - 367	
HPMFV25	833	960065	1 - 266	15 - 280	R56205, N31111, AW403866, and AA338327.
HPMFV78	834	932529	1 - 466	15 - 480	C18404.
HPMFV13	835	575908	1 - 436	15 - 450	A1245605, A1733581, AW195539, AA994974, and AL050350.
HPMFV65	836	867657	1 - 341	15 - 355	AL031282.
HPMFV70	837	577642	1 - 346	15 - 360	AC005383.
HPMFV92	838	577603	1 - 348	15 - 362	AL008730.
HPMGA83	839	968359	1 - 512	15 - 526	
HPMGB22	840	506379	1 - 308	15 - 322	Z85999.
HPMGC07	841	920313	1 - 367	15 - 381	A1214759.
HPMGC23	842	703835	1 - 421	15 - 435	AA309957.
HPMGE31	843	867648	1 - 422	15 - 436	
HPMGE95	844	873392	1 - 796	15 - 810	
HPMGF06	845	954823	1 - 551	15 - 565	AA034305, A1752781, W38450, AA295920, W69345, AW368627, W01351, AW167099, AA491113, A1093592, A1628843, AA470016, AA459627, R70436, W16698, H30472, R72510, R27103, A1986035, A1926603, H25748, AA432254, W67475, R53035, AA617710, AA865403, AA412294, AA431234, AA514353, A1002434, W69267, R37917, R24912, AA443912, H24995, R72497, and X52574.
HPMGF32	846	577615	1 - 355	15 - 369	AC006960.
HPMGH16	847	577641	1 - 402	15 - 416	
HPMG103	848	924521	1 - 387	15 - 401	AA308643.
HPMG184	849	920326	1 - 269	15 - 283	
HPMGJ93	850	864040	1 - 347	15 - 361	AA361434.
HPMGK37	851	575924	1 - 414	15 - 428	
HPMGK59	852	671936	1 - 492	15 - 506	W51873, AA215789, AA215316, A1654057, A1809466, A1761758, AA292627, N24002, A1860134, AA279010, AA215628, AC003032, and Z56178.
HPMGK62	853	730751	1 - 517	15 - 531	R82057, and A1828591.
HPMGM33	854	854081	1 - 648	15 - 662	AA702486, A1630976, AW339792, AW418628, A1690212, A1350097, AA830893, AA703551, A1458500, AA936420, AW402861, and AB020714.
HPMGMS4	855	577599	1 - 342	15 - 356	AL050074.
HPMGR80	856	506235	1 - 380	15 - 394	AW409684, T06413, AB003151, AP000688, and AB033064.
HPMGSO9	857	575951	1 - 99	15 - 113	

HPMGS24	858	796440	1 - 354	15 - 368	
HPMGT67	859	970815	1 - 111	15 - 125	
HPMGV12	860	968364	1 - 288	15 - 302	
HPMGV15	861	582596	1 - 261	15 - 275	
HPMGV59	862	577635	1 - 264	15 - 278	AW242577.
HPMGW48	863	920309	1 - 428	15 - 442	
HPMGX23	864	575903	1 - 301	15 - 315	AI806968, AI080168, AI207589, AB006572, and AF091095.
HPMHA80	865	970813	1 - 282	15 - 296	AL133605.
HPMHB74	866	577595	1 - 539	15 - 553	H09672, and AI937462.
HPMHB83	867	531382	1 - 364	15 - 378	
HPMHC74	868	577631	1 - 357	15 - 371	AL008709, and AL020990.
HPMHD66	869	928433	1 - 429	15 - 443	AI247199, AW166611, AI254913, AA833896, AA833875, AA644090, AI818737, AL048466, AW069227, AI460050, R81017, AA613624, D44639, AA603530, AA307598, AW270385, AA634786, AI682665, AA468022, AL047349, AI687343, AI753113, AA528390, AW302017, AA707849, AA984187, AI925579, AA526724, AI084348, AI278972, AI040054, AI791150, AI867058, AA580808, AA633920, AW188742, AI634187, AI537458, AI004591, AA847499, AA639946, AA574442, AI591375, AA643770, H63092, AW305371, AA651632, AA837035, AA558560, AA862179, AI216990, AW270256, AA846959, AA581247, AI908093, AA626040, AA084609, AI469577, AI049955, AI720195, AW131043, AA314891, AA714011, AA456924, AA481887, AI732869, N23913, AA191418, AI635279, AW068316, AA452887, H15652, AI283312, AA176605, AA846944, AA904275, AA704393, N64587, AA834777, AA515728, AA601356, AI457313, AW440545, AI521525, N40092, F30158, AA493226, AA364453, AA583394, AI537020, AA229975, AA521323, AI244127, AA837671, W01985, AI962030, AI580707, AW265138, AA521399, AA086318, AI344948, AA362349, AI302994, AI524360, AA806796, AA721645, AC000025, AC004796, AC005736, AC005081, AC005899, L78810, AB026906, AC005581, AC004382, AL133448, AC006241, AC004000, U96629, AL096703, Z98884, AL133245, AL035685, AC006077, AC005844, AC004098, AC007227, AC004876, AC005746, AC004686, AL078604, AL033517, AL023807, AF196969, Z99755, AC005180, AC005800, AC016025, AL022313, AL132777, AC004253, Z97181, AC004881, Z82172, AC004973, AC004890, AC002110, AL079305, AC003663, AL132985, AC005632, AC006047, AC004019, AL031846, AC007327, Z84482, AP000313, AC002104, AC004913, AP000299, AC005102, AC004447, AC005725, AC000120, AC007666, AP000066, AC006014, Z71183, AC004476, AP000193, Z99716, U62293, Z93023, AC005619, AC000052, AL034429, AC005089, AC006441, AL031311, AC005783, AL080243, AC010170, AP000050, AF053356, AL024507, AF134726, AL035494, AC005768, AL031662, Z83844, AC005231, U47924, U41193, AC005740, AF111169, Z81364, AP000117, AP000269, AC005920, AC006197.

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HPMH71	870	760426	1 - 147	15 - 161	
HPMJ01	871	914759	1 - 254	15 - 268	AC005484.
HPMJ05	872	930844	1 - 356	15 - 370	AC006977.
HPMJD88	873	930806	1 - 637	15 - 651	
HPMJE84	874	867587	1 - 411	15 - 425	AL035091.
HPMJF76	875	965642	1 - 346	15 - 360	AC005946, AL049740, AL022157, Z82211, U95626, Z83843, AC003029, and AL133162.
HPMJ181	876	930873	1 - 310	15 - 324	AA745410, AI469172, AA341228, AW167267, AA605274, AI471543, AW173651, AI672135, AA370185, AW236342, AI284640, F37169, AI908628, AA630362, AW265393, W07122, AI281881, AI287651, AF150152, AI299050, AI648558, AA515435, AW008317, AW440976, AA100372, AA441788, C16409, AW270270, AI653905, AW162489, AI148277, AI279165, T06828, AI133164, AL120687, AA654771, AA348311, AA626404, AI802526, AA614069, F36273, AI471481, AW080120, AA204655, AI291124, AW419262, AA350859, AI291268, AI537030, AI499094, AI610159, F32894, AA747472, AA338522, AA827981, AI493217, AI446464, F18638, F03097, AW148792, AW151727, AL138265, T07324, AA515905, AA318822, AL041368, AA558015, AA381147, AA578481, H88666, T09071, AA284179, AL038474, AA604897, AI312149, AW021583, AW303876, AA346454, AI889923, AI168185.

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HPMJN59	877	946876	1 - 547	15 - 561	<p> AA278625, AL043338, AA417787, AI917735, AW303607, AI819365, W23045, AI243857, AA157110, and AA278626. </p>
HPMJO46	878	922649	1 - 293	15 - 307	
HPMJR02	879	917419	1 - 505	15 - 519	AC005406.

HPMJV08	880	958001	1 - 430	15 - 444	
HPMJY55	881	922657	1 - 423	15 - 437	AC006443.
HPMKBI9	882	969478	1 - 837	15 - 851	H66737, AA610385, A1825101, and AC006453.
HPMKI53	883	957997	1 - 200	15 - 214	
HPMKM81	884	894416	1 - 880	15 - 894	AW130066, A1826186, AW150146, A129308, AW392049, A129351, AA453884, A1278397, N24006, AA453799, A1796331, AA336728, N74882, AW380924, AA369050, A1868063, AW131507, AC004774, D31734, AF033011, U67840, L24443, AF022075, AF022077, AF022076, U25274, AF096161, L09729, U03876, Z63754, and Z63755.
HPMKNA3	885	867573	1 - 626	15 - 640	AA457012, and AC002310.
HPMLE04	886	867533	1 - 562	15 - 576	N89001.
HPMLK02	887	918123	1 - 497	15 - 511	AA848128, and Z93244.
HPMLK76	888	922621	1 - 477	15 - 491	
HPMLL74	889	953069	1 - 493	15 - 507	R66945, and A1090443.
HPMLW10	890	963037	1 - 330	15 - 344	Z71183.
HPMSF86	891	509490	1 - 323	15 - 337	
HPRAE13	892	971652	1 - 461	15 - 475	A1097067, A1383144, AA370038, and AC005746.
HPRAN84	893	585489	1 - 315	15 - 329	AA370352, AA370860, AA024451, AL118518, AC007016, AF064859, AC004707, Z84718, and AP000351.
HPRAU45	894	536630	1 - 214	15 - 228	AA370859, AA370351, AC002536, and AL034371.
HPRAZ10	895	968692	1 - 452	15 - 466	AA398734, AA393413, and AA371065.
HPRBA65	896	655537	1 - 228	15 - 242	AA371132, AA371091, AW270853, A1978920, A1468384, A1971306, AA361429, and AC005156.
HPRBE36	897	655587	1 - 318	15 - 332	AA371242, AA757085, and A1018367.
HPRBL91	898	655693	1 - 286	15 - 300	AA370885, and AC002366.
HPRCB11	899	960316	1 - 338	15 - 352	
HPRCB21	900	655725	1 - 306	15 - 320	AC007198.
HPRCOC8	901	939490	1 - 284	15 - 298	AA298484.
HPRCOC61	902	964909	1 - 321	15 - 335	AA370278.
HPRCN41	903	655554	1 - 343	15 - 357	
HPRCU13	904	968521	1 - 265	15 - 279	AC002352.
HPRSB16	905	666295	1 - 258	15 - 272	
HPRTL26	906	849081	1 - 405	15 - 419	AA370571, and A1905054.
HPRTF73	907	708761	1 - 292	15 - 306	AA369901.
HPVAB11	908	967944	1 - 567	15 - 581	A1923663, AA458636, AA193435, AA252059, W94787, A1470629, AW016321, and AA193532.

HPVAF49	909	655578	1 - 412	15 - 426	
HPVAF69	910	753744	1 - 415	15 - 429	A1584019, and R79760.
HPVAH36	911	525537	1 - 479	15 - 493	AA296794.
HPWAF85	912	655691	1 - 606	15 - 620	U18010, A1699466, and L77587.
HPWAH48	913	655527	1 - 143	15 - 157	
HPWAS77	914	908450	1 - 725	15 - 739	AW139964, W81697, AW088477, A1887846, AA447817, AA447667, AA677404, R93353, AA831618, AA574189, A1124782, AA584550, AA055366, F13631, AA765804, AW268271, AA939318, AA679335, AC008173, AC004074, AF146367, AF124523, AF118808, AL096775, AL109954, Z83841, AC002464, AC005820, AC006048, AP000509, D84394, AC007359, AC008175, AC006499, AL136130, AL096801, and W81696.
HPWBA33	915	655733	1 - 213	15 - 227	
HPWBO84	916	867289	1 - 330	15 - 344	T65635, A1354862, AA017323, H48816, A1187056, AA829490, AA507745, T47324, AA548692, H91844, AA565232, AA640022, T08163, N22395, AA524604, AA524829, AA373304, A1818505, Z83844, AL031255, AC012384, AC004408, AC006449, AC002996, AC004149, M89651, AC005529, AC004491, AL031228, AC002357, AC002425, AC004531, AC004947, AC005837, AC004051, AL049779, U52112, AL132774, AC004690, AC005225, AC006162, AC007686, Z69303, AC006006, AC004231, AC005323, AL136295, AC002511, AF107045, AC006077, AC004596, AL050317, AL022324, AC006275, AL080245, AL035427, AL031053, AL049776, AL024507, AC005399, AC004682, AP000688, AC002375, AL078476, AL121825, AC004552, AC005839, AC007052, AC005527, AL049829, AC007055, AC003049, AP000555, and AF124730.
HPWCA53	917	657484	1 - 354	15 - 368	A1075673, and AC008015.
HPWCJ27	918	655614	1 - 344	15 - 358	
HPWCJ67	919	655560	1 - 367	15 - 381	
HPWCJ82	920	655577	1 - 472	15 - 486	T20053.
HPWDA73	921	514113	1 - 643	15 - 657	AW338702.
HPWDA86	922	961529	1 - 240	15 - 254	AW080827, A1535841, AC002038, AC002041, and AC006352.-
HPWDD72	923	537333	1 - 528	15 - 542	H68009, AA532955, and AC005189.
HPWSB35	924	655713	1 - 329	15 - 343	
HPZAB38	925	655591	1 - 241	15 - 255	
HSWAC73	926	710354	1 - 396	15 - 410	AA300733, AW070249, and AC0000089.
HSWAD39	927	705322	1 - 785	15 - 799	AW264269, AW028491, AA424983, AA418896, AA418895, AA460211, A1800304, A1685341, A1188340, A1160534, N26011, AW057810, and A1917673.
HSWBD86	928	785439	1 - 138	15 - 152	R59356, F10756, AA480322, A1768068, T15624, A1760446, A1870727, AA534696, AA679825, A1868057, A1274320, AA716748, A1922465, and AA907744.

HSWB140	929	711066	1 - 613	15 - 627	AI610767, AA128537, AA045673, H26372, AI564965, C00296, H27484, AA045672, and AF153882.
HSWBO34	930	868007	1 - 839	15 - 853	AI264314, AI656489, AA608739, AI040264, C15165, AI922383, AA644468, AI391663, AI285883, AI538754, AI696671, AA578673, AI587042, AA843485, R27828, AI927062, AA888452, AI379567, AI093793, AA502801, H95376, AI696130, AA032171, AI697448, AA032170, N66388, AI948739, AI499520, and D00629.
HTEAA54	931	923070	1 - 694	15 - 708	AA382253, AI806382, and AI478870.
HTEAB52	932	537136	1 - 582	15 - 596	AA382333, AA382331, H52860, and AL040167.
HTEAD32	933	504353	1 - 362	15 - 376	AA382382, AA382236, and AC006305.
HTEAD95	934	961232	1 - 451	15 - 465	AA382376, AA382242, AA860376, and AC006445.
HTEAF07	935	835805	1 - 312	15 - 326	AA382453.
HTEAF26	936	537271	1 - 301	15 - 315	H53354, AA758164, AA448168, AI025042, AI829657, AA382854, AA382293, AA400727, AA442764, and AA812451.
HTEAG50	937	787500	1 - 297	15 - 311	AA382498.
HTEAK57	938	536769	1 - 411	15 - 425	H09661, AW196402, AA760720, AA432259, AI539284, AI805310, AA781214, AW268890, AI797250, AW235912, AA993321, AI017538, AW274549, AA884002, AI017535, AI217337, AW014623, AA868679, AI808721, AI769073, N62418, AI364253, AA909554, AA382799, AI917688, AA485055, AL080136, and AF079363.
HTEAL28	939	963538	1 - 666	15 - 680	AA429726, AA398189, H53400, AA382855, AA382294, AA383397, AA382295, AA382880, and Z58143.
HTEAP91	940	966113	1 - 746	15 - 760	AA411883, AW444833, AA382955, AA889519, AI217183, and AA781849.
HTEAR84	941	783328	1 - 237	15 - 251	AA382996, AA180840, AI929073, AL133353, AF132966, and X66366.
HTEAV43	942	927010	1 - 583	15 - 597	AA770016, AW195558, AA757200, AW340425, AW182241, AA383009, and AI191751.
HTEAY67	943	679390	1 - 433	15 - 447	AA383288, AL044302, AA398247, AI916926, AI970265, AA399313, AI806241, AI208574, AA994365, AA382290, and AL137385.
HTEAZ54	944	793441	1 - 499	15 - 513	AA383257, AA812455, and AL137538.
HTEBC74	945	887782	1 - 308	15 - 322	AA383466.
HTEBD35	946	967959	1 - 303	15 - 317	AA383417, and AA383322.
HTEBD40	947	779134	1 - 457	15 - 471	AA383323, AI950478, and AL121757.
HTEBJ78	948	779265	1 - 1003	15 - 1017	AA383746, AF012361, AI918814, AI638690, and AF088868.
HTEBP39	949	742218	1 - 577	15 - 591	AL040588, and AW386895.
HTEBS30	950	693377	1 - 326	15 - 340	
HTEBS77	951	933904	1 - 592	15 - 606	AA102609, AA903522, AA810166, AI887877, AA928872, AI912645, AI628759, AI652056, AA372813, AA326308, AA313595, AA252658, AA491058, AA205648, AW375850, AA252657, and AA082983.

HTEBS80	952	854052	1 - 381	15 - 395	AA399558.
HTEBX62	953	508150	1 - 404	15 - 418	AL133028, and AB033037.
HTEBY08	954	960427	1 - 344	15 - 358	M78063, A1560292, H50301, AA340759, AA340760, H45375, U09355, and AF096153.
HTEBY15	955	526281	1 - 252	15 - 266	
HTEBY28	956	923026	1 - 609	15 - 623	AB033083.
HTEBY41	957	711523	1 - 230	15 - 244	
HTEBY61	958	967340	1 - 421	15 - 435	AA725713, AL040570, R48431, and AC020663.
HTEBZ21	959	958381	1 - 340	15 - 354	AF193806.
HTECA13	960	507053	1 - 393	15 - 407	AA382976.
HTECA16	961	764416	1 - 482	15 - 496	AI017997.
HTECA21	962	911369	1 - 688	15 - 702	R20356, H09898, and R13239.
HTECA32	963	947605	1 - 779	15 - 793	
HTECA51	964	708860	1 - 414	15 - 428	AI479803, R89200, AA382300, AA700729, and AL035450.
HTECA83	965	870692	1 - 446	15 - 460	
HTECB21	966	921070	1 - 359	15 - 373	
HTECC13	967	971673	1 - 301	15 - 315	
HTECC20	968	963353	1 - 993	15 - 1007	AI521186, AI287890, AW006015, AI739342, AI536021, AI915154, D59412, AI382968, AA723799, C14160, and R58305.
HTECC37	969	508143	1 - 317	15 - 331	
HTECC38	970	844558	1 - 553	15 - 567	AL042436, AI125824, AA437087, AI028669, AI024321, AW241753, AA400083, AA953011, AA972296, AI674705, and AL042437.
HTECC66	971	790937	1 - 409	15 - 423	AW375961, H12646, N46186, AI114644, AA133382, AA314626, T92864, AA482645, AA203566, W20194, AA878228, W80608, AA699466, AA482495, Z25122, AA490161, AA939181, AI635552, and AF113691.
HTECC80	972	796820	1 - 446	15 - 460	AL079435, AW070333, AA868621, AI024608, AI208541, AA644440, AA992264, AI219709, and AL078621.
HTECC85	973	508138	1 - 337	15 - 351	AA219332, and AW274715.
HTECC96	974	959874	1 - 547	15 - 561	AL039822.
HTECD17	975	508108	1 - 397	15 - 411	Z68165.
HTECD18	976	973163	1 - 614	15 - 628	T36107, T19204, AF012359, and T36109.
HTECD36	977	518124	1 - 421	15 - 435	AL079683, T69495, AA377984, AA411067, W19966, AL135463, AA152011, AI080369, AI928496, AI969686, AW150086, AW162108, AW245409, AW245596, AW087350, AI660688, AW025370, AI986318, AA417624, AW073180, R65681, AA609692, AI568566, AF015913, and AF167572.
HTECD62	978	527207	1 - 242	15 - 256	AI018016, AA927826, AA781742, AI206323, and AI699610.

HTECD75	979	727422	1 - 410	15 - 424	AA770236.
HTECE09	980	620494	1 - 363	15 - 377	AA074745, AA311579, AW369123, AW377808, AW369199, AA305128, AA279742, AA382491, AA457232, AA350374, and AF119664.
HTECE44	981	764830	1 - 349	15 - 363	AI016755, AA626104, AI215071, AI968379, AA506126, AI340264, AI214879, AI653073, AI208052, AW235456, and AA609852.
HTECE45	982	790894	1 - 349	15 - 363	AA702149, AI760177, W87526, AL042666, AA721639, AA721643, and R55626.
HTECE69	983	522983	1 - 340	15 - 354	AA209512, and AF084521.
HTECE91	984	522984	1 - 283	15 - 297	
HTEDF13	985	522964	1 - 370	15 - 384	
HTEDF23	986	522966	1 - 319	15 - 333	
HTEDF57	987	964734	1 - 467	15 - 481	AA206531, AA205273, AF134584, AF133655, R57172, AA370673, AL049834, AF144487, and AF144488.
HTEDF76	988	522973	1 - 371	15 - 385	
HTEDG16	989	925527	1 - 1246	15 - 1260	AI341284, AA954970, AA971333, AI656306, AI341232, AI962769, AI970130, AI015246, AI149570, AW236864, AI187784, AI824998, AI699532, AW087767, AA776716, AA758202, H75549, AI282907, and AC003691.
HTEDG34	990	761752	1 - 601	15 - 615	A65985.
HTEDH21	991	522764	1 - 307	15 - 321	AW237166, and AI806759.
HTEDH22	992	522765	1 - 412	15 - 426	AA884595, AI004070, AI652358, AI933335, and AC006012.
HTEDH54	993	957762	1 - 398	15 - 412	AI142272, AW303480, and AL117355.
HTEDI02	994	921243	1 - 693	15 - 707	AW166305.
HTEDI16	995	932292	1 - 830	15 - 844	AI200759, N35603, and AI806635.
HTEDI82	996	536477	1 - 536	15 - 550	
HTEDJ04	997	519940	1 - 151	15 - 165	
HTEDJ30	998	771404	1 - 576	15 - 590	AA938733, AI830416, H99099, AI768985, AA410878, AA969071, AI220012, AI568973, AI354321, AW130634, AI219538, AI280159, AI751123, AI693274, and Z61810.
HTEDM08	999	960303	1 - 243	15 - 257	AA383292, and AA010475.
HTEDO31	1000	870711	1 - 279	15 - 293	
HTEDO51	1001	530592	1 - 336	15 - 350	
HTEDO59	1002	964379	1 - 277	15 - 291	AL050310.
HTEDP15	1003	870675	1 - 309	15 - 323	AC008119.
HTEDP31	1004	870548	1 - 526	15 - 540	AC004674.
HTEDP32	1005	839532	1 - 412	15 - 426	
HTEDP83	1006	536821	1 - 391	15 - 405	AA382559.
HTEDQ30	1007	530589	1 - 192	15 - 206	AA470110.

HTEDQ72	1008	795332	1 - 463	15 - 477	AA424209.
HTEDQ83	1009	530586	1 - 493	15 - 507	
HTEDR71	1010	761585	1 - 303	15 - 317	AJ003479, AJ003512, AJ003478, AJ239328, and AP000219.
HTEDR91	1011	530451	1 - 363	15 - 377	AA778548.
HTEDU45	1012	870708	1 - 1168	15 - 1182	AA401417, AI654822, AA131789, AA401393, AA040136, AA030057, AA040089, AW002428, AA131796, AI809387, AI208853, AI798677, AI808134, AA028977, AA131846, and AI468240.
HTEDU48	1013	932315	1 - 718	15 - 732	
HTEDV02	1014	921114	1 - 152	15 - 166	
HTEDX22	1015	523959	1 - 552	15 - 566	T64832, Z45475, and F12119.
HTEDX55	1016	530452	1 - 345	15 - 359	AL035450.
HTEDY38	1017	771505	1 - 128	15 - 142	
HTEDY54	1018	922964	1 - 845	15 - 859	AI141062, AA779725, AA451707, AA453324, and AA954529.
HTEDY57	1019	530580	1 - 314	15 - 328	
HTEEA03	1020	925399	1 - 227	15 - 241	
HTEEB18	1021	523962	1 - 537	15 - 551	AA995142, AC005661, and Z65242.
HTEEB33	1022	924818	1 - 601	15 - 615	AL049780, and AC007055.
HTEEC10	1023	968517	1 - 353	15 - 367	
HTEEE65	1024	530157	1 - 372	15 - 386	AI243357, AI126440, AI693753, and AA783013.
HTEEF31	1025	924840	1 - 333	15 - 347	
HTEEH31	1026	507814	1 - 279	15 - 293	
HTEEU23	1027	524059	1 - 314	15 - 328	
HTEEU52	1028	530199	1 - 331	15 - 345	AL040261, AI525252, and AI025700.
HTEEU88	1029	698315	1 - 355	15 - 369	AA383576, T04917, T35202, AI422683, AI694269, AW341450, AW172298, AI253197, AI392973, AI817020, AI675030, AW149563, AI830691, AI288333, AI420397, AI768573, AW300444, AW271819, AI862664, AW165982, AI761400, AI826256, AI368689, AI697857, AI889625, AI972408, AI357436, AI421517, AI651095, AI283759, AI634398, AI523543, AI948511, AW196914, AI992087, AI417903, AI827278, AI927043, AW237591, AI831948, AI831197, AI830712, AW085599, AI375540, AI300150, AI936396, AI082343, AI190058, AI369782, AA937125, AI926819, AA872799, AI831516, AA502373, AI823952, AI262912, and AL035461.
HTEEU92	1030	960127	1 - 471	15 - 485	AI005426.
HTEEV53	1031	523957	1 - 298	15 - 312	
HTEEW73	1032	917206	1 - 862	15 - 876	AI125404, AI247364, AI208217, AA910021, AI915307, and T11495.
HTEEZ95	1033	530095	1 - 134	15 - 148	
HTEFJ53	1034	935982	1 - 210	15 - 224	

HTEFM31	1035	771355	1 - 449	15 - 463	AL137385.
HTEFN15	1036	959854	1 - 480	15 - 494	
HTEFO32	1037	529272	1 - 137	15 - 151	
HTEFO76	1038	770270	1 - 404	15 - 418	
HTEFP14	1039	659369	1 - 289	15 - 303	AL080239, and AL030997.
HTEFP50	1040	507219	1 - 398	15 - 412	AI733211, AA977235, and AI793144.
HTEFP61	1041	711399	1 - 339	15 - 353	
HTEFS60	1042	836010	1 - 308	15 - 322	Z84469.
HTEFU46	1043	920604	1 - 182	15 - 196	
HTEFW55	1044	787550	1 - 720	15 - 734	Z20330.
HTEFW56	1045	528019	1 - 344	15 - 358	
HTEFW78	1046	961061	1 - 327	15 - 341	AA416708.
HTEFX53	1047	842047	1 - 301	15 - 315	
HTEGA13	1048	656077	1 - 260	15 - 274	AA304950, and AC005237.
HTEGA17	1049	964198	1 - 1718	15 - 1732	AA861754, AI041049, AA974148, AI025824, AI015271, AA973722, AI262750, AF012394, H44966, H45019, H65081, H65127, H65128, H65081, N30790, N32825, N41565, AA021000, AA037708, AA158991, AA158990, AA552704, AA581540, AA583387, AA594383, AA568601, AA639650, AA962753, AI076864, C01177, C17452, AA610069, AA677739, AA678002, Z17891, Z17844, Z17858, D29489, D31204, D31401, D31430, AI147272, AI348141, AI434148, AI446782, AI401705, AI473505, AI475244, AI560742, AI565331, AI479120, AI567547, AI569204, AI570723, AI571642, AI521092, AI587097, AI619824, AI619826, AI683822, AI745345, AI700348, AI862997, AI891040, AI805378, AI805561, AI814808, AI917522, AI924990, AI925791, AI925824, AI926709, AI932677, AW008971, AW025107, AW028354, AW028895, and AW044371.
HTEGA43	1050	715583	1 - 293	15 - 307	
HTEGA47	1051	503300	1 - 305	15 - 319	AA469976, and AA382993.
HTEGD11	1052	967698	1 - 454	15 - 468	AI739081.
HTEGE44	1053	528017	1 - 460	15 - 474	
HTEGF78	1054	614242	1 - 394	15 - 408	AA320491, AA461257, T96959, AA620998, AI803092, AI598264, AI802911, AA613500, AI701066, AA873354, AA976002, AI337726, AI401363, AA889162, AW449691, AA460950, AI435494, T91835, N47591, T08650, AI672896, AI015106, AI122076, AF082179, AF173643, and AF088884.
HTEGF95	1055	796660	1 - 264	15 - 278	AI809182, and AI014526.
HTEGG07	1056	954115	1 - 450	15 - 464	
HTEGG61	1057	528007	1 - 203	15 - 217	

HTEGK51	1058	520046	1 - 137	15 - 151	AA496105, AL038451, AA020916, AA214222, AL038833, AW239553, AL038903, AL036026, W94506, H11258, H19187, T09424, AW163336, AA084982, AA853848, AA852612, AA134785, T30709, T31235, R13838, T30596, T31277, T32509, F08351, T30996, R61645, AI002404, AA281162, N33973, W63690, AA056138, AA400554, AA224046, AW160678, AA252722, AA308905, H37946, AA159207, AA337592, H15180, N36548, T78050, AI214139, H45908, AL036764, AL038918, AA486190, N99529, AA176166, T29922, AA173378, AI929392, AA993699, T32147, W92551, AA314753, W20343, AI028519, W52361, R12459, R17656, D30841, D56168, AA018894, AW375983, AA318870, R57052, AA083038, AA018506, AA401854, W94711, H82178, AB014888, AB015799, AF075601, AF060703, AB015798, AF080569, AB028854, and AF035962.
HTEGM38	1059	675087	1 - 350	15 - 364	
HTEGN63	1060	520037	1 - 196	15 - 210	AB007131, AP001052, and AP001051.
HTEGO05	1061	932583	1 - 1086	15 - 1100	AA059465, AA059211, AA731209, AA236961, T86500, T87461, AL024498, and M35862.
HTEGQ21	1062	923059	1 - 419	15 - 433	AA382826, AA382492, AI917341, AI967930, AI990328, AI041198, AW135194, AI936466, AI990195, AI336861, AI825657, AA609860, AI652939, AI950262, and AI968690.
HTEGQ74	1063	573865	1 - 358	15 - 372	AL133660.
HTEGR36	1064	959871	1 - 186	15 - 200	
HTEGR88	1065	871611	1 - 405	15 - 419	D80168, D59627, C14298, D51079, D59695, D52291, D80949, AW360780, D59503, D51213, C14227, D80290, C14389, AW377669, AW352172, T11417, D80258, D80064, D58246, D59889, D52059, D45273, D80014, D80391, AW377661, D59787, D80196, D57483, T03048, C16955, AI557751, D59484, AI535686, Z33452, C06015, AI557774, T02974, C04682, AA514184, H67854, H67866, AI525216, AI525228, D51053, AI535961, D80251, N66429, AI525969, AI525238, AI525222, AI525227, AB010386, AR016808, U37689, I81198, X64588, I82446, AB019242, and A47134.
HTEGS16	1066	527914	1 - 340	15 - 354	
HTEGS34	1067	458520	1 - 391	15 - 405	AA610046, AA725767, AA609763, AA694482, AI674115, and AI222344.
HTEGS93	1068	506653	1 - 395	15 - 409	AA459933, and AA460208.
HTEGT29	1069	870638	1 - 463	15 - 477	AA725598, AA437008, AA758847, and AA383617.
HTEGT33	1070	716783	1 - 505	15 - 519	AI208922, AF012358, AC000359, AF176024, and AC000357.
HTEGU13	1071	520041	1 - 380	15 - 394	AL037365, AI968379, AA397716, AI016755, AI340264, AA626104, AA435927, AA506126, and AL133624.
HTEGU32	1072	524053	1 - 492	15 - 506	
HTEGU62	1073	573885	1 - 307	15 - 321	AP000275, AP000105, AP000037, and AC002452.
HTEGU93	1074	764831	1 - 721	15 - 735	AA210913.
HTEGV08	1075	959888	1 - 425	15 - 439	
HTEGV60	1076	822954	1 - 484	15 - 498	

HTEGV84	1077	870240	1 - 759	15 - 773	AI809518, AA725632, AA400546, AW303510, AA621301, AA400438, AI184200, AI016652, AI698674, AA758091, AA757258, AA725799, and AA705799.
HTEGW41	1078	573880	1 - 406	15 - 420	AF169385, and AF149310.
HTEGW94	1079	794350	1 - 526	15 - 540	
HTEGX74	1080	783829	1 - 544	15 - 558	AA789286, AI339366, AI656082, AA861573, AA416690, AI808240, AA889130, and AI216654.
HTEGY01	1081	917214	1 - 438	15 - 452	
HTEGY85	1082	573849	1 - 300	15 - 314	AL080197, AP000346, and AL022324.
HTEHB07	1083	870707	1 - 336	15 - 350	AA383326, and AI672505.
HTEHC20	1084	526704	1 - 313	15 - 327	Z98752.
HTEHC47	1085	973071	1 - 723	15 - 737	AA436088, AI149899, AI002083, AA411806, AA470059, AA781801, AA416972, AA435988, AA758635, and AA707529.
HTEHC60	1086	965998	1 - 610	15 - 624	
HTEHC78	1087	573882	1 - 332	15 - 346	
HTEHE60	1088	795264	1 - 551	15 - 565	AI018790, AA885492, AI377750, AW340453, and AC007114.
HTEHE67	1089	784926	1 - 677	15 - 691	AA421403, AA411967, AA412565, AI825585, AW136990, AI962705, AI825455, and AA889516.
HTEHE78	1090	932312	1 - 357	15 - 371	AA642104, AA664126, N66948, AI753334, N70325, AA601713, AA320178, H53040, AA577770, H53039, AA515742, AI222360, AA837716, AI109628, AC006064, AI022721, AP001052, AC004694, AI109801, AI117258, AI109759, AC004884, AC005476, Z95116, AI022159, AC005015, AC003101, AI035086, Z99943, U91323, U91318, AC007773, AC005261, AC002350, AI031289, AC005081, AC005529, U73640, AC005552, AC007040, AI133244, AC006163, AC007285, AC007057, AI121655, AC006324, AR036572, AP000092, AC005829, AI132777, AP000512, AC000025, AF107257, AC005520, AF107258, AP000236, AC004814, AC006581, AC010168, AC005790, AI049759, AC005519, AI022316, AC004100, AI031427, AC007688, AI031584, AC009516, AC006449, AC006441, AC005387, AP000501, AI121652, AP000510, AI049539, U91321, AC003071, AC004908, AC005921, AD001527, AC005800, Z92542, AI034548, AF196969, AC004552, AC009181, AC005971, AC004966, AC004815, AI031681, AC007617, AF196779, AC004707, AB023050, Z83844, AC002312, Z82190, AC007172, AC004990, AC002565, AC007386, AF134726, AI034549, Z82208, Z95329, AC005037, AC007637, AC005162, AI031680, AI022165, AF026069, Z97184, AC006966, and AC003086.
HTEHE91	1091	790342	1 - 520	15 - 534	AI653740, AI223017, AA393574, AP000346, AI022324, and AI080197.
HTEHF13	1092	667224	1 - 319	15 - 333	
HTEHF66	1093	836999	1 - 424	15 - 438	AI137678, and AI109657.
HTEHG44	1094	933624	1 - 682	15 - 696	AA446074, AI224924, and AA868166.

HTEHI06	1095	935984	1 - 817	15 - 831	AA394226, AA398139, AA025620, AA451812, AA454022, and AC012599.
HTEHI14	1096	526687	1 - 444	15 - 458	
HTEHI54	1097	533960	1 - 338	15 - 352	R19058, Z44007, F06961, and F05366.
HTEHI62	1098	922559	1 - 390	15 - 404	AI202243, AA687318, and AI184808.
HTEHI93	1099	870629	1 - 317	15 - 331	
HTEHI64	1100	530749	1 - 235	15 - 249	
HTEHK40	1101	660875	1 - 317	15 - 331	
HTEHK70	1102	771432	1 - 430	15 - 444	
HTEHK81	1103	573866	1 - 414	15 - 428	
HTEHL96	1104	573859	1 - 390	15 - 404	AA926746.
HTEHO56	1105	787521	1 - 664	15 - 678	AL042716, AI634081, AI656008, AI383457, AA298264, AW274940, AW183456, AI824911, H48934, and AI015007.
HTEHP02	1106	920625	1 - 429	15 - 443	
HTEHP20	1107	967443	1 - 379	15 - 393	AA393345, AI018421, AI018412, and AI621296.
HTEHP50	1108	531505	1 - 219	15 - 233	
HTEHP60	1109	573853	1 - 439	15 - 453	
HTEHP67	1110	751866	1 - 425	15 - 439	AA429653, and AL137385.
HTEHP80	1111	573830	1 - 354	15 - 368	AL042482.
HTEHR83	1112	573841	1 - 260	15 - 274	AW117582, and AW275130.
HTEHS19	1113	529280	1 - 324	15 - 338	
HTEHU20	1114	573813	1 - 345	15 - 359	AA625735, and AI205755.
HTEHU68	1115	786378	1 - 362	15 - 376	AI808748, and AA868749.
HTEHU73	1116	870083	1 - 377	15 - 391	
HTEHV72	1117	920610	1 - 356	15 - 370	AA449587, Z62660, and Z62661.
HTEHV86	1118	785652	1 - 454	15 - 468	AB007926.
HTEHW03	1119	924832	1 - 439	15 - 453	
HTEHW21	1120	760552	1 - 286	15 - 300	H99838, AL037447, H98172, R99332, and N73909.
HTEHX03	1121	924826	1 - 502	15 - 516	AI198906, AI743542, AI807563, AI392615, AI813744, AI150517, and AI150519.
HTEHX32	1122	772643	1 - 440	15 - 454	AI699984, AA470157, AI018717, AI917728, AA398746, AA393334, AI216704, AA868127, and AL049742.
HTEHX51	1123	668553	1 - 200	15 - 214	AC004148.
HTEHX92	1124	527167	1 - 477	15 - 491	
HTEIA60	1125	859130	1 - 442	15 - 456	AA594897, Z46029, AA316462, T27008, AA306099, FI2789, R05542, AA635902, T75086, T35592, AW378962, R28411, AA740171, T52620, AI021707, and AI236698.
HTEIA80	1126	721831	1 - 265	15 - 279	

HTEIB14	1127	963099	1 - 700	15 - 714	AI126171, AW172978, AI802445, AI811298, AI807074, AI635206, W96514, AI624106, AI190433, AI810701, AL043767, H43143, AI271523, AI911113, AA644026, AI803788, AI566934, AI187824, AA043579, AI869010, AI015017, and R55050.
HTEIF40	1128	958355	1 - 578	15 - 592	AI806847, AA431560, AI219847, AA913948, AI633873, AI638029, AW003193, AI990760, AA861291, AI190550, and AI187284.
HTEIF68	1129	573828	1 - 263	15 - 277	AA383150.
HTEIG32	1130	699470	1 - 313	15 - 327	
HTEIH70	1131	573826	1 - 186	15 - 200	
HTEIJ17	1132	520113	1 - 425	15 - 439	AF088868.
HTEIJ41	1133	712520	1 - 347	15 - 361	AA037622, AA151557, AA884833, and AI027960.
HTEIJ73	1134	958241	1 - 322	15 - 336	
HTEIJ77	1135	772402	1 - 55	15 - 69	
HTEIK11	1136	967431	1 - 465	15 - 479	AA370836.
HTEIK70	1137	530454	1 - 107	15 - 121	
HTEIK90	1138	789121	1 - 383	15 - 397	AL133625, and AL050310.
HTEIL07	1139	953803	1 - 445	15 - 459	H55431, and AL031843.
HTEIL48	1140	523681	1 - 302	15 - 316	
HTEIL70	1141	520045	1 - 515	15 - 529	AA383469, and AW340027.
HTEIL71	1142	760551	1 - 418	15 - 432	AW374031, AI376865, AA610337, AL031277, AC004159, AL035073, Z83838, AC011422, and AL031286.
HTEIN68	1143	753210	1 - 333	15 - 347	
HTEIN95	1144	839884	1 - 602	15 - 616	AI638483.
HTEIO02	1145	920622	1 - 365	15 - 379	AW188204, and AL078587.
HTEIO12	1146	653244	1 - 322	15 - 336	
HTEIO28	1147	573803	1 - 344	15 - 358	
HTEIP88	1148	941155	1 - 253	15 - 267	
HTEIP92	1149	523892	1 - 356	15 - 370	
HTEIQ74	1150	765794	1 - 576	15 - 590	AA905565.
HTEIR33	1151	928058	1 - 504	15 - 518	AI041198, AW135194, AI336861, AI917341, AI825657, AI936466, AI967930, AI990195, AI990328, AA609860, AI652939, AI950262, AI968690, AW043968, AI695938, AI918858, AI207159, AI961172, AI635425, AA382492, AA382826, and Z54930.
HTEIS65	1152	573775	1 - 444	15 - 458	
HTEIU75	1153	779163	1 - 535	15 - 549	
HTEIU92	1154	870652	1 - 390	15 - 404	
HTEIV54	1155	922027	1 - 859	15 - 873	AA608560, AW119083, AI805320, AW241508, AA478132, AI935179, AA478131, AW241453,

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HTEIW86	1156	784657	1 - 476	15 - 490	AA884237, and Z66028.
HTEIW27	1157	829698	1 - 790	15 - 804	AL040266, AA045127, H71355, AA070703, AA036715, AA325559, AA043642, AA196645, H94227, AA305440, AA383234, H61672, H06121, R60099, AL042836, AI016643, AW410572, AL042837, and AI018804.
HTEIW37	1158	573891	1 - 340	15 - 354	
HTEIX28	1159	836011	1 - 725	15 - 739	AA878363, AL040461, AI806762, AL040944, N48708, AA961620, AI015474, AI122718, AI674958, AI925550, AA316256, AA846418, AI270517, AA383573, AW087494, Z40157, AA915976, AA927218, AA912892, AI216366, D20536, AL109748, and AL078614.
HTEIX85	1160	864251	1 - 364	15 - 378	AI143096, AA476476, AF112968, and AF133914.
HTEIY52	1161	963536	1 - 365	15 - 379	
HTEIY69	1162	577783	1 - 342	15 - 356	AA860220, AA373213, AA095300, AA294896, AA056395, AW369291, AA081316, AA081068, AA258633, AA491648, T78543, AI565548, T68394, D81309, AA303509, C02623, AA552624, C15625, W65448, and H56519.
HTEIY80	1163	955242	1 - 640	15 - 654	AI206714, AI962380, AW139167, AI341507, AW197295, AF146793, and AC004673.
HTEIZ76	1164	523764	1 - 373	15 - 387	
HTEJB20	1165	528015	1 - 336	15 - 350	AW119138, AA508616, and AC000386.
HTEJB25	1166	530590	1 - 364	15 - 378	AI804160, AI287878, AA400787, AI003207, AF176315, AF042089, AC007040, AC000385, and AC004967.
HTEJB81	1167	870644	1 - 326	15 - 340	AC005230, and AL031230.
HTEJC28	1168	573774	1 - 292	15 - 306	
HTEJC95	1169	772989	1 - 412	15 - 426	
HTEJE15	1170	908360	1 - 577	15 - 591	AI217144, AA399617, AA398976, AI025074, AA758412, AW449170, AI953070, AI337133, AI654417, AA608877, AI969018, AA400066, AA401568, AL137462, and S75275.
HTEJE50	1171	520049	1 - 410	15 - 424	AA383469.
HTEJF45	1172	942476	1 - 704	15 - 718	AA927155, AI989936, AI870479, AW196902, and AW137017.
HTEJG24	1173	526278	1 - 432	15 - 446	
HTEJJ43	1174	774243	1 - 505	15 - 519	
HTEJL21	1175	573742	1 - 460	15 - 474	AA913820, AW138390, W37338, AI139797, AW135343, AA776708, AA621016, AW274952, AI623224, AI125250, AA778537, AI208106, AI637631, AW341652, AA776715, AI204215, AA609761, AI671266, AI023591, AI950399, AA758819, AW104292, AI188024, AW058598,

HTEJM56	1176	952255	1 - 392	15 - 406	AA460183, AI969065, W37337, and AA824405, AL042395, AA504349, AI693474, AI125391, AL041671, AW168041, AA838043, AI990015, AI864457, AI149664, AI738586, AL041569, AW294188, AI805280, AA579771, AW273185, AI653680, AW197733, AI138789, AI699335, AI475427, AA883961, AI203057, AI968077, AA383594, AA976749, AI648684, AI952360, AI680162, AI590021, AW076093, AW264516, AI073952, AI568870, AI564719, AI623828, AA808060, AI683684, AI866457, AI628292, AW196868, AW075413, AI590686, AI867042, AI922365, AW081255, AI285586, AI249375, AI610293, AW103878, AI915576, AW403717, AI475455, AI811860, AI282903, AI539808, AI873644, AI174394, AI469811, AI831140, AI872910, AI690585, AI539829, AI863191, AI613270, AI625464, AI281660, AI870187, AI886022, AI269862, AI624293, AI920833, AI680498, AI934259, AI610114, AW193026, AL121270, AI289337, AW075657, AI364788, AI383919, AW168723, AI922901, AI636719, AW073697, AI863321, AI270055, AI633073, AI624543, AI610645, AI702433, AI611743, AI690312, AL039276, AI689420, AL045500, AW080992, AI687065, AI432040, AL048656, AI819326, AW238730, AI445976, AI744256, AA572758, AL045163, AI627880, AI866741, AI805385, AI612721, AL119791, AW079159, AI343059, AI619716, AI828731, AI612759, AW089179, AW151729, AI696819, AI870192, AI567351, AI349933, AI934011, AI280661, AI699011, AI537617, AI919345, AI251830, AW088899, AI366549, AI539153, AW088144, AL036214, AI866608, AI859464, AI866585, AI499986, AW149236, AW083804, AI862144, AW170734, AI696626, AL040241, AI54821, AI589993, AW059713, AI921082, AL038445, AW168425, AI345111, AI446373, AI358701, AL036638, AI537677, AI621179, AI433157, AI539771, AI798258, AI922577, AI471361, AI500659, AI288285, AI889168, AI344935, AI866573, AW068845, AW103228, AL045620, AI476109, AI815232, AI801325, AI500523, AI573060, AW302965, AA640779, AI345608, AI582932, AI284517, AA613907, AI500706, AI445237, AI491776, AI758613, AW151138, AL042628, AI521560, AI889189, AI500662, AI284509, AI439452, AI857724, AW148320, AI633493, AW169653, AI434256, AI344785, AI249962, AL041772, AI609677, AI888661, AI811344, AI284513, AI620284, AI888118, AI349614, AI872051, AI589273, AI866510, AI569583, AW302992, AI801112, AW088903, AI440252, AI800152, AI963068, AI569632, AI274769, AI348854, AL036664, AW023590, AI608676, AI345471, AW088134, AA579232, AA494167, AW075084, AI468872, AA420722, AI537307, AL120853, AL040243, AI251205, AI924971, AI287489, AI698401, AI524607, AI683714, AL043632, AL043326, AI538342, N71180, AI433976, AC003688, AF096834, AF073955, AF073954, AL117585, S68736, A08916, A08910, AR000496, U39656, A08909, I48978, I89947, A08913, U72620, I89931, I49625, AL049382, AF090896, AL080060, I26207, AL137556, AL137283, AF113753, AL137538, AF104032, AB019565, A93350, X93495, AF158248, AL122093, AL137527, AL050393,
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HTEJN10	1177	958389	1 - 412	15 - 426	AA397714, and AI688816.
HTEJN49	1178	558383	1 - 244	15 - 258	AL033527.
HTEJN96	1179	573845	1 - 341	15 - 355	
HTEJP10	1180	914785	1 - 406	15 - 420	AA173098, AA330453, N72370, AA382609, D82507, AA305139, AA376308, AA319043, AA360655, AA204809, N47351, L48818, T97397, H74112, AA303102, N98390, T85235, R92534, AI400282, W78773, AA226439, N77177, AA135383, AA089951, N28003, AA094694, AA036797, and D82374.
HTEJP66	1181	916481	1 - 697	15 - 711	AW402599, AA402458, N28458, W04863, AA683291, C17218, AA452695, AA321934, AA325890, AA148436, AA083939, W95796, AA203350, AA373216, H87410, R96313, N29206, W60562, N55788, W32702, N40125, AA319796, T27329, AA360583, H49227, AA402577,

HTEJP71	1182	767955	1 - 616			AA027923, AA115050, AA150348, AA496191, W05840, N35260, AA382795, AA210879, AA346660, AI902181, AF172940, AF151885, and AC007298.
HTEJT37	1183	530596	1 - 339		15 - 630	H59767, AA252573, R52747, AW303359, AW151618, AA811707, AA939308, AI205601, and X80437.
HTEJT74	1184	676254	1 - 438		15 - 353	AI092208.
					15 - 452	AA393248, AA393292, AI796754, AA293815, AA459841, AI075905, AW137492, AI652522, AI217933, AI150346, AI694956, AA399502, AA398164, AI024099, AA719008, AA629029, AA861041, AA402463, AA435622, R24468, R66361, AA688372, AF081250, and AF081249.
HTEJU30	1185	573823	1 - 304		15 - 318	AC000093.
HTEJV62	1186	694525	1 - 325		15 - 339	AA813665, AI025041, and AI215603.
HTEJX78	1187	806395	1 - 411		15 - 425	AA496111, AW138142, AA306268, AA417106, AA382596, AI027705, AA383788, AI824924, AA382469, AA812546, AA382920, AI183592, AA383156, and AI828862.
HTEJY21	1188	530156	1 - 426		15 - 440	AI695191.
HTEJY27	1189	685272	1 - 239		15 - 253	AA853991, AA778707, AW182416, AA634398, and AA609856.
HTEJZ26	1190	523818	1 - 262		15 - 276	AW247046, AA401701, and AA398161.
HTEKC07	1191	920925	1 - 389		15 - 403	AW087802.
HTEKC12	1192	815975	1 - 345		15 - 359	AI539455, AI218279, AI348415, AW408773, AW340548, AI368160, AA894774, AA937067, and AW364691.
HTEKD04	1193	519938	1 - 418		15 - 432	
HTEKE41	1194	974044	1 - 735		15 - 749	AI091681, AC009405, AC003683, AI239321, AC007253, AL009173, AL030995, Z99572, and AL109853.
HTEKE46	1195	870084	1 - 1112		15 - 1126	AI125483, W77994, AI161017, W73951, AI250771, AA777158, W94063, AA912611, AA339877, AI265865, and AA339786.
HTEKE80	1196	790381	1 - 523		15 - 537	
HTEKF04	1197	774260	1 - 732		15 - 746	AA609512, AW074860, AW119172, AA626238, AA759162, AA609090, AA421396, AW070485, AA421292, AW303549, and AC007999.
HTEKF24	1198	573750	1 - 412		15 - 426	AF001846.
HTEKF35	1199	573749	1 - 253		15 - 267	
HTEKF68	1200	772997	1 - 567		15 - 581	AW263561, AW183891, AI005584, AI216442, AA983878, AA815385, AA868890, and AI004495.
HTEKI01	1201	917176	1 - 416		15 - 430	
HTEKI70	1202	503039	1 - 686		15 - 700	AI830436, AA187445, AA383192, H91927, AI640587, and AI989949.
HTEKJ48	1203	530588	1 - 235		15 - 249	
HTEKM14	1204	745257	1 - 312		15 - 326	
HTEKO49	1205	723148	1 - 383		15 - 397	AA699599, AI275162, N27054, R09201, and AC006211.

HTEKQ26	1206	870627	1 - 314	15 - 328	
HTEKQ85	1207	784444	1 - 555	15 - 569	
HTEKR75	1208	870555	1 - 412	15 - 426	
HTEKS15	1209	529273	1 - 414	15 - 428	
HTEKS20	1210	846714	1 - 1063	15 - 1077	AI936596, AA868353, AI797296, AA725553, AI221970, AA429551, AA428462, AA629305, AA629047, AA431190, AI073397, AW235895, AI123443, AI808267, AA609412, AI914363, AA953895, AI214385, AA431516, AA911681, AA781953, AI825106, AA298758, AI215028, AA909534, AA723768, DI0393, and S63991.
HTEKS21	1211	506651	1 - 333	15 - 347	
HTEKS76	1212	767658	1 - 495	15 - 509	AI990484, AI917746, AW182169, AI216456, AA723888, AI018419, and AA969884.
HTEKX06	1213	935945	1 - 426	15 - 440	
HTEKX08	1214	959876	1 - 490	15 - 504	AL042392, AI147451, AA758821, AW450252, AA399310, AI656343, AI636668, AI190733, AA725709, AI025812, AA398244, AA723645, AA382463, AA709253, AI139837, AA401777, and A57391.
HTEKX28	1215	920927	1 - 286	15 - 300	AA393705.
HTEKX70	1216	573700	1 - 304	15 - 318	
HTEKZ50	1217	524054	1 - 304	15 - 318	H89084, AA296876, AL023876, AC011422, AP000962, AL020989, AL049563, AL022575, AL031183, AL009028, AL031391, and AC002487.
HTELA50	1218	774268	1 - 497	15 - 511	AI670826, AA058736, and Z99297.
HTELD47	1219	934272	1 - 1005	15 - 1019	AA229071, and AA229024.
HTELD82	1220	779315	1 - 510	15 - 524	AI377684, H03750, H84635, AA625639, and R22878.
HTELE10	1221	963563	1 - 495	15 - 509	
HTELE41	1222	791743	1 - 601	15 - 615	AI684943, AW117611, AI418517, and AI418516.
HTELG47	1223	757740	1 - 442	15 - 456	
HTELG57	1224	870621	1 - 441	15 - 455	
HTELG80	1225	773018	1 - 251	15 - 265	AW341441, AI651145, AI919149, AI247339, AA412289, AI218635, AI650567, AW340087, AA709187, AW118140, and AW183314.
HTELH44	1226	766462	1 - 658	15 - 672	AI298565, H92427, AW452904, AI361759, AW449414, AA004711, R75764, F04362, AC006480, AL035414, AL133404, AC004486, and AL035072.
HTELI03	1227	923071	1 - 575	15 - 589	AC005157.
HTELI51	1228	806403	1 - 654	15 - 668	AI022339, and Z99127.
HTELI89	1229	966134	1 - 376	15 - 390	AA397525, AA399055, AA758883, and AL022101.
HTELK14	1230	794339	1 - 453	15 - 467	Z99716.
HTELK50	1231	870552	1 - 227	15 - 241	AL078475.
HTELK68	1232	923055	1 - 646	15 - 660	

HTELL48	1233	783824	1 - 515	15 - 529	
HTELL51	1234	952267	1 - 635	15 - 649	
HTELL90	1235	952269	1 - 940	15 - 954	AA913156, AI221124, AA305153, and AF106564.
HTELM89	1236	786268	1 - 288	15 - 302	AI591200, AA102066, AI867662, AW088720, and D26018.
HTELO20	1237	926910	1 - 420	15 - 434	AL031597.
HTELO51	1238	931120	1 - 378	15 - 392	AI540890, AI557426, AI557082, AI541027, AI547225, and AI541056.
HTELO73	1239	761806	1 - 514	15 - 528	
HTELO93	1240	934344	1 - 249	15 - 263	AL078613.
HTELP27	1241	921621	1 - 564	15 - 578	R80089, X85707, and X85708.
HTELQ41	1242	922634	1 - 449	15 - 463	AA310475, AI536833, AA319470, AA278518, AA319408, W20004, AI611260, AA418173, AI968286, AW182252, AA315267, AA491655, AW170378, and AI904985.
HTELQ87	1243	761768	1 - 449	15 - 463	AI125340, AI125684, AI377949, AA884214, AI126470, AI218351, AI243952, AA723933, AI240603, AI143979, and AI187742.
HTELR90	1244	826531	1 - 437	15 - 451	AA652491, and AF152924.
HTELT72	1245	761598	1 - 447	15 - 461	AI827560, AI336053, AA873745, AA451732, AI436724, AA923591, AA055247, AW189536, AA747873, and Z40977.
HTELT83	1246	780619	1 - 699	15 - 713	AA746627, AA398848, AA435892, AI208905, AI024568, AA861337, AA861875, and AA910621.
HTELU01	1247	915339	1 - 367	15 - 381	AL033517.
HTELV06	1248	934302	1 - 457	15 - 471	AI799028, AW263660, AA861674, and AA993711.
HTELV10	1249	963576	1 - 256	15 - 270	
HTELV26	1250	796832	1 - 435	15 - 449	AI198878, AI190586, AI018804, AL042837, AI208256, AA725583, AI016643, AA833661, AA626323, AA993365, AI018351, AA718913, AA725636, AA992718, AI183840, AA403023, AI911045, R60037, AA398422, AW410573, AA749431, AI128961, AI077415, AI198777, AI439996, AI934676, AI199096, AA682387, H92998, AI200368, AA778651, AA045098, AW157530, AW250790, AA587915, AW188549, AI819989, AI951978, AW007464, AI951992, AI376410, AI677931, AA778720, AI364379, AA584288, AW162769, AI040155, AA150015, AI187131, AA977318, AI373112, AI000432, AI038499, AI076148, AI278114, W94564, AA513466, AA946608, AI279549, AI758476, AW103741, AA836837, AI700221, AI253749, AI913907, AA057355, AI038357, AI758826, H71311, AW004637, AW273537, AA186980, AI885648, AA824341, W70033, T35014, AI262733, AI693026, AA196549, AI868298, AI090830, T16464, AL042836, AI887548, AW025276, AI139138, and AA150080.
HTELV43	1251	870615	1 - 434	15 - 448	AC007746.
HTELV86	1252	910946	1 - 1086	15 - 1100	AI272244, AA382531, AI809639, U35371, and X99043.
HTELW29	1253	952241	1 - 768	15 - 782	AW117507, AW105238, AW105158, AA969617, AI692859, AA934716, AA383047, and

HTELW62	1254	870596	1 - 486		AI917691.
HTELX52	1255	963506	1 - 345	15 - 500	AA393684, AA813816, and AI700752.
HTELX72	1256	761599	1 - 216	15 - 359	AI220445.
HTELY64	1257	764834	1 - 437	15 - 230	
HTELZ07	1258	952268	1 - 535	15 - 451	
HTELZ89	1259	786424	1 - 451	15 - 549	
HTEMA54	1260	911666	1 - 1484	15 - 465	AI954673, AI220421, AA813119, AA382989, AI024406, AF113526, AB023063, and AF113519.
HTEMB26	1261	827055	1 - 130	15 - 144	AC004900.
HTEMB28	1262	870614	1 - 402	15 - 416	
HTEMB34	1263	870589	1 - 533	15 - 547	
HTEMB72	1264	761602	1 - 294	15 - 308	
HTEMB83	1265	775593	1 - 370	15 - 384	AA778498, AI337034, AA609166, AA625857, AI201263, AA437287, AI678062, AI961118, AI203907, AI917789, AA626247, AA927799, AI187708, AA442366, AW294301, and AL050341.
HTEMC18	1266	924727	1 - 447	15 - 461	AI813375.
HTEMC75	1267	848193	1 - 296	15 - 310	M78994, R86687, T08961, AW402241, R46318, AA349761, AA350295, AA354235, HI5340, AI909793, D31764, and AF037332.
HTEMD10	1268	963546	1 - 673	15 - 687	AA625914, AA416795, and AC005858.
HTEMD73	1269	761783	1 - 430	15 - 444	AI026681, AA609997, AA382092, AA789295, and T12649.
HTEMF08	1270	958386	1 - 494	15 - 508	
HTEMJ34	1271	786377	1 - 550	15 - 564	AI142370.
HTEMJ54	1272	963531	1 - 558	15 - 572	H59039.
HTEMK03	1273	923066	1 - 347	15 - 361	
HTEMM80	1274	888686	1 - 869	15 - 883	AA759198, and AA968427.
HTEMN08	1275	958374	1 - 232	15 - 246	
HTEMN95	1276	789113	1 - 311	15 - 325	
HTEMO14	1277	880634	1 - 407	15 - 421	
HTEMO85	1278	771434	1 - 485	15 - 499	AA804990.
HTEMP48	1279	767863	1 - 348	15 - 362	AL049761.
HTEMP49	1280	932319	1 - 774	15 - 788	AA933702, AL036538, AA928649, AA393559, AW104883, AA974777, AA587615, AA594505, AI351083, AA406036, AI004273, AI217923, AA923027, AA435495, AI128197, AA496058, AI187946, AI026847, AA865921, AA383556, AA927439, and AL117564.
HTEMR65	1281	909280	1 - 1112	15 - 1126	AW003084, AA574346, AW188065, AI657112, W37979, AW162204, W37760, AW172598,

HTEMS10	1282	963527	1 - 386	15 - 400	AI655693, AA283822, AI937864, AA454174, AI016572, AW044162, AW162368, AI420414, AI804706, and AI567345.
HTEMS48	1283	832506	1 - 341	15 - 355	AW082687, AA774543, AW195592, AW274057, AA460327, AA382893, AI126206, AI198578, AA682221, AW183102, and AA911099.
HTEMT06	1284	934338	1 - 636	15 - 650	AA045732, AA412195, T70810, T85978, H26344, AA293873, AI343622, and AC004231.
HTEMT89	1285	922999	1 - 630	15 - 644	AI016782, AI149777, AA448011, AA448155, and AI285926.
HTEMU17	1286	789623	1 - 335	15 - 349	AW003548, AA757091, AW014801, AA813302, AA437209, AP000220, and AP000084.
HTEMU54	1287	870618	1 - 436	15 - 450	W90717, and W90708.
HTEMX92	1288	913795	1 - 525	15 - 539	AP000470.
HTEMY30	1289	870662	1 - 219	15 - 233	
HTEMZ04	1290	927021	1 - 363	15 - 377	AL048534, AA403281, N78348, and AL031255.
HTENA22	1291	870601	1 - 720	15 - 734	
HTENB03	1292	923050	1 - 476	15 - 490	AL080132, AC011594, AC006238, R38805, R49132, R49132, H06801, N66174, N98697, AA043641, AA146965, AA147010, AA259116, AA259155, AA534491, AA570283, AA687335, AA766643, AA910635, AA948152, AA401719, AA609258, AA626320, AA644562, AA680291, AA757030, AA758747, AA888971, AI023819, AI032507, AI088947, AI274536, AI345946, AI431770, AI192387, AI214901, and AI217881.
HTENC22	1293	775544	1 - 560	15 - 574	
HTENF08	1294	958378	1 - 743	15 - 757	AW195712, D44825, AI124542, and AB032984.
HTENF95	1295	795316	1 - 333	15 - 347	
HTENG66	1296	840151	1 - 295	15 - 309	AI473748, AI798241, AA279454, AL138273, and AW149414.
HTENG93	1297	967432	1 - 91	15 - 105	
HTENH86	1298	784798	1 - 601	15 - 615	AA393073, AI139819, AA860114, AA412161, and AA868102.
HTENI58	1299	917213	1 - 636	15 - 650	AI970129, AW237169, AI621267, AI653036, AI797400, AI797725, AW182923, AI961057, AI970364, AI191623, AL036577, AW188292, AI341330, AI655836, AA918201, AI202983, AI825213, AI824962, AI990770, AA890172, AI982569, AI918790, AI205504, AI611043, AI969360, AW293674, AI203082, AI828842, AI634070, AI962396, AA757981, AI917843, AI867911, AI824830, AA903616, AI968361, AA781952, AL036578, and AA629230.
HTENJ28	1300	968135	1 - 1014	15 - 1028	AI240133, and AF032967.
HTENJ76	1301	767838	1 - 431	15 - 445	AF012383, AI307797, AW270088, and U86074.
HTENK06	1302	835851	1 - 552	15 - 566	AB020719.
HTENK69	1303	844557	1 - 899	15 - 913	
HTENO12	1304	917032	1 - 1454	15 - 1468	AL042436, AL042437, AI674705, AA400083, AW241753, AA401372, AI218464, AA953011, AA972296, AA812520, AI125824, AA437087, AI028669, and AI024321.

HTENQ50	1305	969213	1 - 635	15 - 649	AA905347, AA371108, T20204, Z43158, and AA151400.
HTENP54	1306	787535	1 - 494	15 - 508	AA496169, and AC009411.
HTENP80	1307	775387	1 - 482	15 - 496	AL035453.
HTENQ05	1308	928244	1 - 641	15 - 655	AA393064.
HTENR10	1309	963530	1 - 575	15 - 589	
HTENR74	1310	764828	1 - 444	15 - 458	AI823791, and AF069682.
HTENR93	1311	920834	1 - 875	15 - 889	AI381463, AA634395, AA406053, AA405219, AA383176, and AF121781.
HTENS22	1312	785996	1 - 532	15 - 546	H83100, AL044519, and AL137391.
HTENS43	1313	784936	1 - 1079	15 - 1093	AI971582, H58143, AI499833, AI393537, and AA973074.
HTENS91	1314	870515	1 - 720	15 - 734	AA225153, AA629286, AA225136, AI272649, AA909816, AA070899, AI866377, AA229443, R67086, AA084212, AW243884, H59093, AA158549, AC002086, AL133304, AC000004, AL049830, AC006050, AC007270, AL031846, AC006125, D43727, AL031670, AC002470, AL050318, AC007114, AF001549, AP000329, AL135959, AC003070, AL034420, AL031286, AC007226, AL049694, AC004143, AL022476, Z93244, Z68284, AP000359, AC005015, AL034429, AC000394, AC006120, AC003029, AL031589, AC004782, and AL035072.
HTENV57	1315	944416	1 - 605	15 - 619	
HTENW53	1316	907717	1 - 806	15 - 820	AA429691, AA429515, AC007114, Z61140, and AC004156.
HTENX77	1317	771409	1 - 521	15 - 535	AA781188, AA460513, AA860910, AA781845, AI027285, AI208471, AA889700, N73782, H08088, R38703, F03385, AI830535, AI474644, R41444, AA459870, AI023552, and AA421081.
HTENY21	1318	870587	1 - 705	15 - 719	AI743533, AI424822, AW082413, and AI915340.
HTENY35	1319	884043	1 - 1011	15 - 1025	AI223811, X85630, T36006, AA382232, Z21393, AA383107, N78092, T36070, T36050, Z21341, Z21392, AA459806, Z21315, AF012377, Z21111, AI827647, AW340665, AA280976, Z21340, T85719, AL043525, AL043526, R82847, AC006208, and AL137671.
HTENZ16	1320	917185	1 - 962	15 - 976	AI018671, AI807205, AI468026, AI797263, AI025828, AW194247, AI889876, AA843455, AI884356, AI198561, AI032059, AI126485, AI889886, AI239452, AA992969, AA780875, AW303976, AI216470, AA683361, AI569512, AI472962, AI885458, AW055338, AW242149, AI911290, AI222107, AI538002, AA912612, AW183126, H79395, AA884115, AI149911, AW189703, AI220396, AI203939, AA936147, AI560168, AI219573, AW243836, AA906293, AI252658, N26330, N26296, AI886564, AW085495, AA927058, and AL133596.
HTENZ33	1321	870591	1 - 616	15 - 630	AA383398.
HTENZ72	1322	773024	1 - 564	15 - 578	AI632084, AI221893, AA383392, AA759214, AW137663, AI269516, and AA923222.
HTEOA90	1323	787516	1 - 489	15 - 503	AA383437.
HTEOD34	1324	812307	1 - 552	15 - 566	AI990671, and AI990110.
HTEOE61	1325	918635	1 - 548	15 - 562	

HTEOF31	1326	793202	1 - 619	15 - 633	AL031283.
HTEOF80	1327	847224	1 - 506	15 - 520	AF186084, and AL117610.
HTEOF85	1328	768583	1 - 494	15 - 508	AI917508, AI810095, and AA973064.
HTEOF91	1329	918571	1 - 237	15 - 251	
HTEOI36	1330	870575	1 - 516	15 - 530	AA298760, AA298759, AA298601, and AL133073.
HTEOI53	1331	810333	1 - 422	15 - 436	AW206247, AI400618, AI671128, AW237084, AI811276, AI337166, AI341186, AI360596, AW235137, AI183637, AI654814, AI654771, AI969744, AI954759, AA417208, AI969746, AW087480, AA417104, AW182372, AA723770, AW241414, AW003345, AW241474, AW183339, AA432142, and AA757062.
HTEOK02	1332	918590	1 - 395	15 - 409	
HTEON29	1333	815852	1 - 978	15 - 992	AW004028, AI968030, AW237673, AA432290, AW138422, AA112090, AA428635, AI143780, AI143791, and AA861634.
HTEON67	1334	954114	1 - 335	15 - 349	AC004533.
HTEOU45	1335	915138	1 - 639	15 - 653	
HTEOV90	1336	870532	1 - 425	15 - 439	AW204420, AW058611, AI767863, AI433866, AI671711, AI802010, AI935766, AA280379, AI808931, AA523871, AI193461, AA827208, AA418269, AI302010, AA280200, AA251664, AI637584, AI932794, AI564719, AI677796, AI538716, AI633125, AI862139, AI433157, AI702073, AI476046, AW050522, AI924971, AW151786, AW198090, AI569583, AI591420, AI590227, AI619502, AW102785, AI826225, AI648663, AI863240, AI886753, AW075381, AI480118, AI270183, AI097248, AI567351, AW152182, AI434468, AW104724, AI863321, AI612759, AI679916, AI271796, AI922365, AI890833, AI926790, AI802542, AI799199, AI636719, AI241819, AI280637, AI696612, AI828731, AI873644, AA833760, AI915291, AI445992, AI874261, AI804983, AI923357, AI670009, AI560099, AI613017, AL036187, AI572787, AI570807, AW026882, AI536638, AI620003, AI624548, AI537244, AA449768, AI433023, AI934026, AW104827, AI537303, AI274508, AI273142, AI955906, AL041772, AI811785, AI796743, AI446248, AA857306, AI863382, AI554427, AI445025, AI274013, AI520702, AI446003, AI889376, AW051258, AW150453, AI699865, AI925156, AW151136, AI923370, AW148320, AI619716, AI539808, AI869367, AI689248, AW075413, AI619607, AI499285, AW029611, AI698391, AI249962, AI680498, AI567814, AI889189, AI554821, AI539153, AI554218, AI784252, AW170635, AI608936, AI569945, AI635464, AI432040, AI537273, AI817552, AI564723, AI612852, AI681985, AI432969, AI828367, AI559296, AI702433, AW075667, AI432030, AI366900, AW148408, AI436644, AI633308, AW169527, AW090550, AI569328, AI627909, AI800411, AI612920, AI919534, AI921176, AI280661, AI499381, AI469112, AI580984, AI934259, AI539687, AI567128, AW193530, AW073270, AI648502, AI783861, AI610690, AI889306, AW169653, AI648684, AW081036, AI491775, AI801523, AW054964, AI469532, AI702068, AW148363, AI819976, AW080992, AW152469,

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HTEOW02	1337	918475	1 - 596	15 - 610		
HTEOW39	1338	870566	1 - 488	15 - 502		Z98304.
HTEOW85	1339	969682	1 - 649	15 - 663		AI684621.
HTEPA08	1340	958391	1 - 1054	15 - 1068		AI041556, AL042783, AA834968, AA789271, AI032390, AA400082, AA757197, AW206997, AA416988, AW235392, AI028342, AI024253, AI015964, AL040413, and AA411964.
HTEPA27	1341	872923	1 - 589	15 - 603		AI765491, AI469067, AI870585, AI870612, AI652881, AA055971, AI763357, AA036000, AA358708, AA889873, AI701794, N56631, AL042137, AI825129, AW297101, and AB018353.
HTEPB66	1342	772949	1 - 610	15 - 624		AW449288, AI147992, AI142275, AI654490, AI002885, AI743450, and AW103158.
HTEPB84	1343	782248	1 - 580	15 - 594		
HTEPC76	1344	767824	1 - 526	15 - 540		AI688792, AA504908, AL138425, AA908950, AI208672, and AF081466.
HTEPC87	1345	883021	1 - 514	15 - 528		
HTEPD06	1346	933299	1 - 341	15 - 355		N47565, N47576, C14331, D80227, D80269, D80378, C14429, D51799, C14389, AW118681, D80391, D59787, D59467, D80196, D80038, D59927, D50995, D58283, D59859, D80022, D80166, D80195, D51423, D59619, D80210, D80164, D59275, D80240, D80253, D80043, D59502, D81030, D81026, D51022, D80212, AA305578, D80188, D59610, D80219, AA514186, AA514188, C15076, D57483, D80024, D80366, AA305409, D50979, D59889, D80193, D80045, C14407, D80133, AW360811, D80241, D80248, D80522, D51060, AW177440, C14014, D80251, AW178893, AW375405, T03269, AW179328, C75259, AW366296, AW377671, AW360844, AW375406, AW360817, AW378534, AW179332, AW377672, AW179023, AW178905, D80268, AW378532, D80132, C05695, AW352171, AW177501, AW177511, D80302, D80134, D80439, AW377676, AW352170, AW177731, AI557751, AW178907, AW178762, D58253, AW179019, AW179024, AI535686, D80247, D51250, AW369651, AW177505, AW178906, AW352174, AW179020, AW178775, AW360841, AW178909, D59373, AW177456, AW179329, F13647, AW178980, AW177733, AW378528, AW178908, AW178754, D52291, C14227, AW179018, AW352158, AW352117, AW176467, T11417, AW179004, AW367967, AW179012, AW178914, AW378525, D51103, D80168, AA926689, AA809122, AI910186, D80157, C14344, AW177728, C06015, AW179009, D51759, D58246, D81111, AW178774, AW178911, AW378543, AW177722, AW352163, C14298, D80064, AI905856, D59503, AW178983, AW178781, T48593, D58101, AW360834, Z21582, AW177723, AW378540, AW352120, D59627, D59653, D80258, AI535850, AW378533, D45260, D51097, C14975, Z33452, AW367950, D80014, AA285331, AW177508, H67854, C03092, H67866, AI525920, AI525923, D51213, AW177497, D80228, AW178986, C14973, D50981, D45273, N66429, T03116, AI525917, D59317, AW177734, D51221, D59474, D60010.

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HTEPE28	1347	932576	1 - 694	15 - 708		AA205046, AA383391, A1184616, AA223825, A1825541, A1469846, and D42084.
HTEPG15	1348	812303	1 - 533	15 - 547		A1937640, T18881, R24582, AA412546, A1083751, AF079564, AF079565, AF106658, AF106659, AF202454, AF202453, and Z63351.
HTEPH01	1349	915301	1 - 618	15 - 632		AA399486, T69681, and AC007537.
HTEPJ09	1350	956200	1 - 1202	15 - 1216		AA394192.
HTEPJ19	1351	918599	1 - 453	15 - 467		T18597, D59751, A1557262, A1525556, Z33559, A1540903, Z32887, D50992, A1557533, A1536138, A1535660, A1541205, D59436, A1526078, A1535639, A1541321, A1541075, C14228, A1557864, A1557238, AA058620, A1557808, A1525500, A1557082, H65400, A1525653, A1535828, A1557809, A1541356, A1557602, A1541365, A1557731, A1525302, A1525316, A1535813, A1546829, A1525757, A1540974, A1557312, A1557317, A1541154, R29657, A1536150, A1541034, A1557852, A1525856, A1535994, A1541353, A1541027, A1541048, A1557258, A1557543, A1525666, A1557041, A1557426, A1536070, A1557039, A1557810, A1525656, A1547177, D30843, A1557408, AR050070, A62298, A82595, A82593, U94592, Z30183, A62300, AF006072, and AR025466.
HTEPJ79	1352	774212	1 - 359	15 - 373		
HTEPK40	1353	939675	1 - 619	15 - 633		A1075905, A1796754, AW137492, A1652522, AA393248, A1217933, AA459841, A1150346, AA293815, A1694956, AA435622, AA393292, AA719008, AA629029, A1024099, AA861041, AA398164, AA402463, AA399502, R24468, R66361, AA688372, AF081250, and AF081249.
HTEPM33	1354	870561	1 - 816	15 - 830		AA824347, AA889787, A1425084, A868962, A1190895, A1132776, and AF083394.
HTEPM52	1355	806471	1 - 444	15 - 458		Z99716.
HTEPN07	1356	952243	1 - 307	15 - 321		
HTEPP23	1357	836572	1 - 327	15 - 341		A1150152, A1216505, AW103179, and AC006017.
HTEPP29	1358	917207	1 - 458	15 - 472		
HTEPP30	1359	947107	1 - 732	15 - 746		AF191546.
HTEPP32	1360	785803	1 - 963	15 - 977		AA402763.
HTEPP92	1361	790869	1 - 596	15 - 610		

HTEPR90	1362	787499	1 - 155	15 - 169	
HTEPT25	1363	870509	1 - 393	15 - 407	
HTEPT75	1364	870637	1 - 630	15 - 644	AI283483, AI873282, and AI827738.
HTEPU01	1365	915134	1 - 704	15 - 718	
HTEPV02	1366	917406	1 - 489	15 - 503	
HTEPX32	1367	870698	1 - 1349	15 - 1363	AI217947, AW237109, AI918745, AI968403, AA934788, and X84693.
HTEPZ10	1368	963433	1 - 529	15 - 543	AI217204, AW183426, and AA759358.
HTEPZ18	1369	888470	1 - 560	15 - 574	AA397836, AI139919, AW162347, AI223276, AI879324, AI200822, AI150592, AI028601, AI200868, AI879701, AI138943, AI652314, AI377443, AA868111, AW160551, and AF177398.
HTEQB03	1370	922941	1 - 396	15 - 410	AI624244, AL120897, AL121756, AC007099, Z99496, AC004584, AC002418, AP000248, AC004386, AL050305, AC002483, AL022315, AL034452, AC004638, AC005899, AC000353, AC004623, Z84476, and U91323.
HTEQD40	1371	915198	1 - 543	15 - 557	AI623182, AA776747, AW082325, AW273819, AI539350, AI810085, AI125567, AI221672, AI200770, AI204194, AW263528, AI240146, AA437189, AA758317, AI192035, AA709217, AA992316, AA758401, AA961979, AI217262, and Z66485.
HTEQD69	1372	918579	1 - 607	15 - 621	
HTEQE87	1373	958354	1 - 729	15 - 743	AA913948, AI633873, AI638029, AI990760, AI806847, AW003193, AI190550, AA431560, AI187284, AI915840, AI286045, AI243468, AA719044, AA448281, AI219847, AW135537, AA861812, AA861291, AI969788, AA812901, AI187727, AI286137, and AI942348.
HTEQG56	1374	881004	1 - 577	15 - 591	
HTEQI54	1375	853971	1 - 603	15 - 617	AW299627, AA917835, AA758010, AI989828, AW103119, and AW241908.
HTEQJ14	1376	870525	1 - 496	15 - 510	
HTEQJ42	1377	806495	1 - 496	15 - 510	AA383039.
HTEQO81	1378	806504	1 - 375	15 - 389	AA382997, and AA397859.
HTEQP45	1379	966141	1 - 127	15 - 141	
HTEQQ82	1380	932301	1 - 590	15 - 604	AA609033, AA293870, AA382673, AW263657, and U51244.
HTEQR15	1381	939641	1 - 756	15 - 770	AI979286, AA382595, and AF133424.
HTEQR94	1382	966486	1 - 556	15 - 570	AI990882, AA447560, AI201149, AI341615, AW002367, AI651854, AA437021, AI149956, AI140621, AW292211, AA620811, AW196416, AA757082, AA993629, AA932499, N92273, AA448543, AI458277, AA398159, AW004057, AI918824, AI635506, AA401699, AA994466, and AI016246.
HTEQT63	1383	924799	1 - 1298	15 - 1312	AI142296, AA417385, and AI148005.
HTLAB19	1384	530577	1 - 347	15 - 361	
HTLAB44	1385	530579	1 - 253	15 - 267	AC006549, AC000097, and AC006547.
HTLAB73	1386	575019	1 - 320	15 - 334	AC000078.

HTLAC81	1387	679414	1 - 192	15 - 206	AF038406.
HTLAC87	1388	546469	1 - 226	15 - 240	
HTLAD21	1389	761758	1 - 490	15 - 504	AI217166, AI184534, AI150079, AI142754, AI697160, AI811701, AI214713, and AW188915.
HTLAD38	1390	421550	1 - 517	15 - 531	
HTLAF84	1391	836390	1 - 558	15 - 572	AA418228, AF045454, D63648, and E13935.
HTLAV67	1392	530742	1 - 208	15 - 222	AC005258.
HTLBD12	1393	506739	1 - 319	15 - 333	AL121757.
HTLBES5	1394	967408	1 - 293	15 - 307	AL036680, AA421020, AW151136, R66759, AL037558, AL045421, AA830821, AW149876, AI571529, AI355008, AI567582, AW089006, AI471361, AW023338, AW020095, AL041150, AW167924, AI829990, AI345224, AI079736, AL046463, AI311892, AW162194, AI697324, T99953, AW243637, AI921167, AA291456, AI539771, AI873638, AI473451, AI805688, AI888621, AI828574, AW022682, AW239367, AI540606, AI689420, AI336662, AL038575, AA464646, AW020693, AI890887, AI590423, AI570966, AI307507, AI916419, AI611728, AI470293, AI929108, AI538850, AI610667, AA572758, AI648567, AW088899, AI805638, AI366549, AI799195, AI866082, AI636719, AI539153, AI620093, AI866608, AI636619, AL120853, AI340603, AI537677, AI611743, AW083804, AI349598, AI582912, AW172723, AI539800, AI696626, AI349256, AW075207, AI589993, AI866573, AI312152, AI365256, AA579232, AA807088, AI343037, AI345735, AW085786, AW265004, AW075084, AI310925, AL038564, AI472536, AI312399, AI677797, AW082600, AI349937, AI567944, AI345688, AI334884, AI307543, AI494201, N71199, AI345251, AW071412, AI307210, AI307708, N29277, AI312325, AW071395, AL036631, AI538885, AI249946, AI244380, AI340659, AI589267, AW071377, AW129230, AI802240, AW161579, AI313320, AI955906, AI310925, AI805769, AI434242, AI313352, AI335363, AI307503, AI539707, AI334930, AI309443, AI623682, AL039086, AI307736, AW161402, AI307520, AI623736, AI446124, AW084097, AI349266, AI349787, AI334452, AI340664, AI310592, AI344938, AI312146, AI866786, AI309431, AI312339, AI340537, AW301300, AI345739, AW161202, AI345674, AI345258, AI538764, AI312143, AI307459, AI349637, AA635382, AI273179, N74355, AI312428, AI499974, AI310927, AL110306, AI311604, AI307578, AA420722, AW162189, AI436429, AI349955, AW189933, AW075093, AI312432, AL120300, AA580663, AI349269, AI312357, AI590943, AI358701, AW021588, AI310945, AL040241, AW088903, AW151714, AL036638, AI636581, AI583445, AW059713, AI648408, AI312237, AI922901, AI446373, AW263716, AI251830, AI343059, AI917963, AI573026, AI349933, AW193467, AW268261, AW082623, AI249877, AL047422, AL133741, AA493923, AI345253, AW409775, AL119836, AI345677, AW167918, AA494167, AW191003, AI633402, AL119791, AW071362, AW021373, AI345608, N98606, AW191844, AI336513, AI357599, AI433968, AI499581, AA848053, AI554821, AW264719, AL046618, AI348895, AI345347, AW269097, AI866465, AI310575, AI589428,

				AI349226, AL046595, AL040694, AA493647, AI537837, AW403717, AA974049, AL036718, AL037454, AI824360, AW058233, AL046466, AI569328, AI434833, AL038605, AW163834, AI886055, AF065135, I48978, Z72491, AF113690, AL035458, AL133104, AF158248, AL050172, AF090934, Y16645, A18777, S78214, AL049382, AF090886, AF113691, A08916, AR000496, U39656, X70685, M86826, I89947, A08913, A08910, I26207, AL117585, I89931, A08909, A08912, Y11587, I49625, AL122118, AF036941, AL080074, AR038854, AF132676, AF061836, AF090900, A08908, AR011880, AL110171, AF090943, X84990, AL133016, AL122110, AF097996, AF118070, AL122050, AL137538, AL117457, AL133568, AF102578, AF028823, A65340, A07647, I48979, X53587, AL080060, AF114170, AF118064, AL133081, AI238278, AF017790, AL122098, U68233, I92592, AL137712, AL080137, AL117394, E01614, EI3364, A03736, M92439, AB016226, AF113677, I42402, AL050108, AL137705, AF067790, I89934, AF087943, E02221, AB019565, A65341, X62580, AL122111, AF210052, AL137574, AF125949, U68387, S68736, AF003737, I89944, AL133093, AL049466, Z37987, AL137658, U58996, AL050092, X87582, AJ000937, AF069506, AF118090, AF192557, AL096744, U78525, Y08769, X63574, A21103, S76508, AF113019, AL133558, AF215669, E02253, AL137560, AL133640, X52128, AF177401, AL080148, AL133565, AF104032, AF113013, AL049465, AL137300, I00734, S77771, I41145, AF012536, AL137429, AF113689, AL049300, E05822, AL137478, AL133645, U95114, AF176651, AB007812, E06743, AL080158, AF017152, AF026124, U96683, AL110221, S69510, AF113676, E00617, E00717, E00778, AL137656, DI6301, AL137527, Y07905, AL050393, AL117435, AL137548, AL122121, AL110280, AL137463, AF111112, S61953, AL080086, AF078844, AL122049, E04233, X80340, AL117583, AL133098, AL117460, X72387, AL133557, X92070, AF090903, AL050116, AL122045, AJ003118, U49434, AL133014, U80742, AL133113, U91329, AJ005690, AL137479, U72620, D83032, AF162270, AL133560, AF126247, I09360, AL049938, X79812, AL122106, AL133075, AL122093, AL137294, U42766, AL117432, AF113694, AL137526, AL133080, AL117649, AL080127, AL133077, AF061573, U00763, AC002467, AL080124, AR068751, Y10655, S75997, AL049464, D89079, AL133067, AL137556, Y16258, Y16257, E02756, Y16256, X06146, AL137557, AL050024, U67958, AL049314, E01314, E07108, M27260, AL050149, A45787, AL133072, AL137273, AF106657, AF030513, AL050138, X93495, X65873, AL137665, E15569, A58524, A18788, A58523, E03348, AL050277, U92068, AL110196, E03349, AR038969, L30117, AJ242859, AR059958, and Y09972. H03896, AA788921, AA985315, and AL133595.
HTLBE82	1395	780116	1 - 467	15 - 481
HTLBF14	1396	971661	1 - 728	15 - 742
HTLBG83	1397	527942	1 - 187	15 - 201
HTLCA95	1398	911655	1 - 1148	15 - 1162
HTLCG77	1399	772644	1 - 98	15 - 112

HTLCX76	1400	767667	1 - 265	15 - 279	AL045710, and AL096749.
HTLCY27	1401	682208	1 - 288	15 - 302	W92263, AA736600, AI962876, AI539379, AI672273, AL045130, AI656897, AW001387, and AI806122.
HTLCY54	1402	908832	1 - 1050	15 - 1064	AA453366, AI188219, AI638044, AA983750, AI219830, AA453265, and AA912820.
HTLCZ48	1403	572959	1 - 399	15 - 413	
HTLCZ96	1404	815897	1 - 459	15 - 473	AW139921, AA725842, AI971598, AI651885, AA453466, AL110422, AI027229, AI026797, AA778573, AI279962, AI073425, AI208767, H55405, and AL118498.
HTLDA58	1405	828115	1 - 259	15 - 273	AA948538.
HTLDE53	1406	780842	1 - 610	15 - 624	AA400498, AA400590, AA861265, AA398875, AI149809, AI198885, AA435582, AA460749, AA460151, AA889548, AI015434, and AA815269.
HTLDE64	1407	908613	1 - 838	15 - 852	
HTLDE95	1408	616724	1 - 285	15 - 299	AA566051, AA552211, AA393552, AA418209, H05646, H06920, R34733, AA293017, Z42496, AI743990, and AA280537.
HTLDF33	1409	909254	1 - 616	15 - 630	AI376558, AI208582, AI149687, AI028197, AA629337, AI027966, AI202003, AA694500, AI701718, AW207552, AI336775, AI560530, AI215526, AW207059, and AI015601.
HTLDG55	1410	911645	1 - 196	15 - 210	
HTLDH65	1411	839795	1 - 901	15 - 915	N47989, AI675771, AI024189, AI651589, AI621081, AW003588, AW293606, AI026721, AA954294, N51195, and AA983886.
HTLDI90	1412	835850	1 - 458	15 - 472	AB020719.
HTLDO94	1413	915223	1 - 542	15 - 556	AA860341, AA889689, AA730148, AA478113, AI024743, AA730132, AA082366, and AA758028.
HTLDP77	1414	920546	1 - 638	15 - 652	AC002128.
HTLDQ25	1415	870057	1 - 1220	15 - 1234	AA399278, AA889597, AA758803, AW117336, AA398195, AA729781, AA889586, and AA922590.
HTLDS55	1416	891322	1 - 1302	15 - 1316	AI890919, AI018797, AA913452, AI797580, AI809012, AI187382, AA448485, AI554914, AW137847, AI393577, AA382830, AA432050, AA609003, and AC020663.
HTLDT05	1417	909752	1 - 473	15 - 487	R59447, RI7647, T62170, and AI439348.
HTLDT81	1418	952265	1 - 480	15 - 494	AA398001, AA399683, AW177623, AA809773, and AL137531.
HTLDU05	1419	911649	1 - 589	15 - 603	AA437044, AF113527, AB023062, and AF113520.
HTLDV31	1420	867748	1 - 297	15 - 311	
HTLDX88	1421	791684	1 - 686	15 - 700	
HTLDY85	1422	573746	1 - 481	15 - 495	
HTLDZ14	1423	573401	1 - 334	15 - 348	
HTLEB14	1424	573464	1 - 402	15 - 416	
HTLED72	1425	906989	1 - 273	15 - 287	

HTLEF94	1426	870258	1 - 309	15 - 323	
HTLEG65	1427	870154	1 - 1167	15 - 1181	
HTLEG91	1428	870257	1 - 99	15 - 113	Z94160.
HTLEH30	1429	934287	1 - 542	15 - 556	
HTLEI47	1430	573460	1 - 463	15 - 477	
HTLEJ11	1431	973302	1 - 956	15 - 970	M62294.
HTLEJ93	1432	960314	1 - 294	15 - 308	AL044506.
HTLEK64	1433	506747	1 - 318	15 - 332	AA442457, AA601393, AC005625, and AC005789.
HTLEL01	1434	917022	1 - 515	15 - 529	AC003976, AC005702, AC005562, and AL117394.
HTLEL03	1435	575080	1 - 93	15 - 107	AF042793, AB011130, AF042792, AF040709, and Z84492.
HTLEL07	1436	953712	1 - 581	15 - 595	
HTLEL31	1437	669950	1 - 131	15 - 145	AA250913, W56681, R24109, H01291, AA161334, AW160808, and AF053356.
HTLEM46	1438	719160	1 - 443	15 - 457	AI760165, AI341569, AW241888, AW135684, AI624778, AA883817, AI494564, AA722107, AA521079, and AA405142.
HTLEO50	1439	506649	1 - 335	15 - 349	Z68869.
HTLEP16	1440	574942	1 - 567	15 - 581	AA305510, AA099550, AI917501, AI631488, AI142135, AW391262, AA305581, N39659, AI829757, and AF151810.
HTLEQ07	1441	953706	1 - 592	15 - 606	AL133071.
HTLES43	1442	573403	1 - 203	15 - 217	
HTLES54	1443	574884	1 - 312	15 - 326	AI207997, and AW172597.
HTLET56	1444	911654	1 - 1096	15 - 1110	AI968198, AI655275, AA397903, AL044119, AW003563, AL044118, and Z74696.
HTLET78	1445	836820	1 - 812	15 - 826	AL041695, AA454137, T19069, D31497, and AL133566.
HTLET93	1446	573454	1 - 99	15 - 113	
HTLEV33	1447	527956	1 - 261	15 - 275	AI808336, AW013835, AI624717, and AI650408.
HTLEV95	1448	883332	1 - 574	15 - 588	AA776758, AI808140, AA884694, AA909615, AA904970, AA909196, AW294544, AA723919, and AI525608.
HTLEW12	1449	870255	1 - 334	15 - 348	R02814.
HTLEW21	1450	573458	1 - 311	15 - 325	AL122083.
HTLEY11	1451	967309	1 - 336	15 - 350	
HTLEY91	1452	775310	1 - 212	15 - 226	AC005343.
HTLEZ14	1453	791662	1 - 322	15 - 336	AC000097, AC006547, AP000344, and AC006549.
HTLEZ15	1454	934288	1 - 368	15 - 382	D51002, AI541205, AI541321, AI557082, AI535660, AI557238, AI557258, AI557602, AI525500, Z33559, T18597, AI557533, AI557731, AI525556, AI557262, H65400, AI557234, AI525757, C14322, D50992, AI525856, AI557241, AI541027, AI525852, AI535639, AA058620, AI540903, AI541365, AI557084, AI541048, N71206, AI557312, AI526078, AI557474,

HTLEZ32	1455	870261	1 - 512			AI525302, Z33585, AI541075, AI541034, AI541346, AI541353, AI541154, AI557039, AI557041, AI557222, AI557317, AI525656, AI546829, AI536070, AI535813, AI525666, AI541056, AI535994, AF025310, Z30183, U45328, AR050070, U94592, A82595, A82593, A63903, A62298, and A62300.
HTLFA74	1456	934172	1 - 695		15 - 526	AC005899.
HTLFC20	1457	917128	1 - 1029		15 - 709	AA398001, AA399683, AW177623, AA809773, and AL137531.
HTLFE01	1458	917033	1 - 591		15 - 1043	AA356490, R05624, AA262044, and AL138430.
HTLFE05	1459	954984	1 - 1305		15 - 605	
					15 - 1319	AW275845, AI830267, AI572906, AI439086, AA766499, AA723111, AA836614, AA453028, AA747738, AA483838, AA077798, AA077483, AW302599, AA215573, AA077013, AA009576, AA078283, AA323484, AA077510, AJ007798, and AC005071.
HTLFE20	1460	934278	1 - 463		-	AC006237.
HTLFI28	1461	775392	1 - 423		15 - 477	AC003963.
HTLFI39	1462	953730	1 - 616		15 - 437	AF053356, and AF174604.
HTLFI83	1463	781303	1 - 501		15 - 630	AL117491, AB007913, AL137693, and AL110281.
HTLFI39	1464	573462	1 - 329		15 - 515	AI001797, and AI910520.
HTLGD25	1465	870136	1 - 1477		15 - 343	AA608970, and AA758832.
HTLGD69	1466	835493	1 - 1010		15 - 1491	AA403179, AA398239, AW339857, and AA952990.
HTLGG36	1467	789656	1 - 561		15 - 1024	AW269804, AA781852, AW104592, AI239999, AI698249, and AC005821.
HTLGGK55	1468	868309	1 - 470		15 - 575	AW393087, R16949, R75708, H44330, AA186786, AA259086, R55419, AA329264, AA335735, AA329538, AA393356, AA354448, W93021, AA136776, T35806, T10451, R46300, R54656, R10335, AA076725, W51754, AL137358, and AL050110.
HTLGM02	1469	964878	1 - 752		15 - 484	C02944, C03248, AI807681, AA095819, AI797565, AI333238, AI863457, H53759, AW138808, AW451889, AW138004, AW207397, AW184023, and AC005216.
HTLGM07	1470	952254	1 - 1194		15 - 766	AI693474, AL042395, AL041671, AW168041, AI738586, AA504349, AI125391, AI990015, AA838043, AI149664, AL041569, AI864457, AA579771, AW273185, AW294188, AW197733, AI805280, AA383594, AI699335, AI138789, AI653680, AI738485, AA383400, AI475427, AA976749, AI203057, AA883961, AI968077, AF096834, AF073954, AF073955, AC003688, and L07578.
HTLGT62	1471	918606	1 - 533		15 - 1208	AL040693.
HTLGW17	1472	958208	1 - 794		15 - 547	
HTLGX90	1473	870528	1 - 1358		15 - 808	
HTLHIC14	1474	908428	1 - 752		15 - 1372	AA399144, AI982647, AA394141, AA234366, AA405404, AA034080, AA644012, AA234434, T86343, AI344623, R02436, T86344, AA707052, R02333, and Z98257.
HTLHE72	1475	963471	1 - 494		15 - 766	AI738485, AI738586, AF096834, AC003688, AF073955, and AF073954.
					15 - 508	AL078621, Z63130, and Z63232.

HTLHL82	1476	958334	1 - 1159	15 - 1173	AA459835, A1286187, AA742548, A1187289, A1392611, AA922025, A1138515, AA884337, and A1936608.
HTLHO94	1477	968685	1 - 460	15 - 474	A1632413, AA026276, AA382241, AA936327, A1026815, AA382375, AA026275, AA860376, and AC006445.
HTLHP32	1478	933335	1 - 615	15 - 629	AW405738, AA116025, AA102802, AA211814, D63260, AA306027, H97316, T78952, X93817, AW136521, A1659011, AW382734, AW374638, AL022316, Z93241, and AF151854.
HTLHP52	1479	926980	1 - 569	15 - 583	
HTLHP80	1480	870156	1 - 590	15 - 604	AA483387, AA065093, AA126035, AA126051, A1871722, AA164944, AA199708, AL044904, Z69651, AP000337, and AC002425.
HTLHT15	1481	946586	1 - 560	15 - 574	T85616.
HTLHT24	1482	870254	1 - 1191	15 - 1205	AA402128.
HTLHU04	1483	926950	1 - 998	15 - 1012	A1869974, AA405686, A1199718, A1969027, AW086198, AL045468, AW082694, AA399273, AW136449, A1933024, AA412383, AA300675, AA405951, AA412243, AL045467, A1150480, AA89135, and A1217882.
HTLHV67	1484	936139	1 - 735	15 - 749	H44302, R50303, AA341701, AA179217, T60490, AA478857, R47809, AA234882, AA302994, A1797287, F12041, T66192, H81762, AW403784, AA171826, A1417037, A1906347, A1436806, AA298718, A1906396, and AF005038.
HTLHZ08	1485	958321	1 - 663	15 - 677	
HTLHZ10	1486	963475	1 - 677	15 - 691	AC005971.
HTLIA92	1487	784817	1 - 723	15 - 737	AA382329, and T27180.
HTLID36	1488	945891	1 - 521	15 - 535	AC003662.
HTLIK11	1489	966043	1 - 471	15 - 485	
HTLIP19	1490	958351	1 - 941	15 - 955	AA431834, AA412657, AA399262, A1970493, A1026627, AA412489, AA431430, AA383405, AL042749, and A1696044.
HTLIQ09	1491	931046	1 - 630	15 - 644	
HTLIR30	1492	870115	1 - 709	15 - 723	
HTLIU76	1493	946300	1 - 829	15 - 843	AA393092, AA453482, AF012388, and AF002992.
HTLIV78	1494	947234	1 - 685	15 - 699	AA846864, A1125243, AA446154, AW003474, A1200764, AW137061, AA992083, A1139618, AA429664, AA991813, AA923010, A1150169, A1825677, A1917106, AA429514, AW029457, AW264822, A1800160, AW085654, A1445992, A1660211, AA761545, AW084368, A1633009, AA113768, A1863191, AL048875, AW117746, A1874189, A1583982, A1634707, AW149869, A1537989, A1140134, A1680138, AL035460, and AF185576.
HTLIY52	1495	942161	1 - 1354	15 - 1368	A1827749, A1819667, A1580407, A1025487, A1223109, A1150036, AW087713, A1024234, T18864, A1479322, AA883975, AW341589, AA860213, A1831802, AA913074, AA608857, A1050685, AA860223, AA948538, and A1075930.

HTLJA23	1496	953729	1 - 943	15 - 957	AF053356, AF174604, and AF083655.
HTLJA24	1497	934279	1 - 560	15 - 574	AC006237.
HTLJC71	1498	922923	1 - 1738	15 - 1752	AL039539, AL045443, AI336919, AA406128, AA405229, AL042307, AA431504, AA311249, AW086440, AA813520, AI240644, AA897733, AW268487, AA782009, AW172455, AI301209, AI014598, AA969918, AL041043, AA431178, AL039540, AA973051, AI221826, AL133030, AC009516, AP000552, AP000556, AP000557, and AL117509.
HTLJD35	1499	967336	1 - 518	15 - 532	
HTLJD88	1500	953714	1 - 865	15 - 879	AL041339, AF025310, and AF200923.
HTLJJ75	1501	924755	1 - 1137	15 - 1151	AA889705, AA224167, AW263624, AI627392, AA907369, AA224175, H41231, AI392654, AI223199, AI208705, AI825010, AL033527, and Z66397.
HTLJL23	1502	922994	1 - 1787	15 - 1801	W02882, AI017323, AW118900, AA912672, AI208003, AA909041, AI765407, AI765419, AA609441, Z33510, AI016233, AI657083, AI339208, AI991437, AA781685, AA860425, AA382780, Z21333, AA357733, Z21332, AA256011, N74515, AL031587, and AF006501.
HTTAD55	1503	835652	1 - 246	15 - 260	AA301270, AA301379, and AA301366.
HTTAE49	1504	723331	1 - 269	15 - 283	AA301335, AA301157, W27731, AA525760, AA449997, AW088581, F07155, AW337237, AI536857, AI524371, AA737106, AA056569, AA491298, AA953587, AI857836, AA515753, AW080777, AA491681, AI766408, AI278972, T39494, R97104, N55508, AI376747, AW081296, AI311647, AI923333, AI207465, F08230, AA531412, AI183976, AA601355, AA953228, AA165505, N73610, AA598927, N72717, AI620992, H72530, AA970967, AI809745, AI923052, AI674840, AI341654, AA648942, T07769, H84675, AA602727, AI950671, H70076, AI270675, R49657, AI908093, AL021939, AL022238, AC004526, AC007546, AL121748, Z98051, AC005368, Z83846, AC004000, L78810, AL021368, AC004447, AL031667, AL049552, AF059650, AL008707, AC004833, AL049745, AC006344, AC006387, AL034419, Z98884, AC004805, AC004996, AL022326, AL035046, AP000080, M31061, M33764, X16277, M81740, U73636, AL031668, AL121658, AC006271, AL133382, AC009286, AC003041, AC007461, AL031587, Z98742, AC005953, AP000557, D87009, AL031311, AC002312, AP000023, AC002350, AL137100, AL022721, AC007051, U07562, AC010209, AC006160, AC007919, AL118510, AC007559, M97911, AC007564, AC004799, AC005067, AC002369, AC005227, AC008122, AL096763, Z95116, AC004947, AC004841, AC003049, AC004655, AC004838, Z85986, AP001053, AC005962, AC008015, AL035086, AC004098, AC005384, AC006115, AC009405, AC006239, AC003684, AP000171, AP000056, AC004477, AC007934, AC003669, AL035078, Z75888, AL049589, AP000967, AC004757, AF106564, U47924, AL078472, AC003038, AC004686, AC004966, AL050318, AC005803, AC005726, AC004228, AC006449, AC004492, AC003091, AC005179, AC004905, AC006552, AF200465, AL049835, AL080242, AL035682, AC005230, AC005484, Z92547, AL031283, AL049759, AL009181, AC004938, AC004008, AF030453, Z98946, AC005088, AC007014,

HTTAH87	1505	509574	1 - 304			U91318, Z98304, AL133245, AP000556, AB020871, AL031845, AL023375, AC005212, AC005857, AL035530, AP000467, AL031864, AL034417, AP000563, AP000211, AP000133, AL022330, AC003093, AL035417, AC005043, AC004032, AL049646, AC005180, Z75887, AC005251, AC004895, AL049554, AC006130, AL031056, AP000330, AC006270, AC006101, AC005884, Z83856, AP000257, and AP000256.
HTTAJ35	1506	707750	1 - 560		15 - 318	AA301200.
HTTAJ50	1507	509657	1 - 249		15 - 574	AA460110, AA279729, AA291197, AA301139, T06789, AW295422, AI700465, AA845564, and AI291478.
HTTAN57	1508	509453	1 - 292		15 - 263	AA300966, and AA301128.
HTTAS96	1509	961057	1 - 247		15 - 306	AA300600, and AA301000.
HTTAU82	1510	797726	1 - 296		15 - 261	AA300802, AA300767, and AC004559.
HTTBE25	1511	509128	1 - 256		15 - 310	AA300687, AA286758, AL139165, and Z70227.
HTTBH34	1512	530565	1 - 313		15 - 270	AA300493, AA300591, AF059569, and AL049778.
HTTBH41	1513	530562	1 - 252		15 - 327	Z42096.
HTTBH54	1514	530563	1 - 302		15 - 266	
HTTBJ94	1515	530564	1 - 311		15 - 316	
HTTBN67	1516	578085	1 - 163		15 - 325	AL046237, and AL045777.
HTTCA15	1517	869705	1 - 413		15 - 177	
HTTCD03	1518	925390	1 - 378		15 - 427	AC005833.
HTTCD71	1519	530393	1 - 112		15 - 392	
HTTCL35	1520	529672	1 - 239		15 - 126	AL049844.
HTTCT34	1521	973210	1 - 1295		15 - 253	AA505142.
					15 - 1309	AW192348, AA081773, H06122, C75208, W38676, AA302953, AI907561, AA311414, AA151050, AW411262, AA226372, AA297279, T50005, AA938031, AI276055, AI433141, AI814125, AA689289, AI264581, AI650824, AW235148, AI273243, AA340545, T50069, AW340759, AW088730, AI093394, W44759, W73928, AI242558, AI800707, AA421100, AA243847, AW265034, AA226593, AW294446, AI097360, AI302409, AI298574, AA770396, AI418623, AA122285, AI150958, R31691, AI969750, AI168830, AW236726, AI459694, AA936951, AA422134, AA150960, AA029400, AW305179, AA046886, AA226401, AI935787, AW118839, R24074, AI803011, AI564140, AI797634, AI671022, AA084054, AA031539, AI831233, AA046979, H79028, H05830, AA033515, AW296225, N70304, R31733, AW296783, H28027, AA334000, F32723, H54170, AA031538, AI826552, AA421099, AA766234, D60652, AI696661, AA913310, AW383613, AI077484, AW383609, AW236130, AA652326, AI191597, H77423, AI435580, AI302073, AI675809, H54014, AI973084, AW383535, AW239479, AA496314, AI971370, AA233111, and AA629153.
HTTDF50	1522	526385	1 - 293		15 - 307	AA301144.

HTTDF90	1523	917155	1 - 427	15 - 441	AW052029.
HTTDG36	1524	968131	1 - 347	15 - 361	
HTTDI21	1525	869686	1 - 341	15 - 355	
HTTDJ65	1526	973307	1 - 406	15 - 420	AC006030, AP000513, AB023052, and AC006140.
HTTDL38	1527	573641	1 - 289	15 - 303	
HTTDL45	1528	523452	1 - 291	15 - 305	AW292800, and AC007390.
HTTDL89	1529	959837	1 - 328	15 - 342	W22023, AC004765, and AB002342.
HTTDN40	1530	734318	1 - 373	15 - 387	AA182963, W39759, AA132990, H69405, R94355, T66121, H68623, H68650, N36314, R14722, AA166770, R70624, AA923755, AW385783, R69735, AA190899, R19750, T10743, H07954, H93885, AA164319, and AC005876.
HTTDN85	1531	783444	1 - 435	15 - 449	AL137653.
HTTDO19	1532	908937	1 - 320	15 - 334	
HTTDO37	1533	573685	1 - 431	15 - 445	
HTTDR91	1534	790336	1 - 549	15 - 563	AA252780, T84947, and AC005740.
HTTDR92	1535	573666	1 - 326	15 - 340	AC003046, AC002366, and AC003685.
HTTDS02	1536	920589	1 - 418	15 - 432	
HTTDX84	1537	921100	1 - 668	15 - 682	AA432195, AA435548, and AA431175.
HTTDZ54	1538	692608	1 - 286	15 - 300	AW163244, H89834, W06845, N42782, N42829, N31946, and A1190785.
HTTDZ91	1539	523206	1 - 300	15 - 314	A1762137, AW242639, AA044752, AA884207, AA235512, A1870472, D80100, D59403, - W88874, AA481286, N92013, D31111, D31113, A1167596, R10048, AA906542, AW087683, R49500, A1361492, AF155112, and AL137478.
HTTEB33	1540	573719	1 - 336	15 - 350	
HTTEH58	1541	747943	1 - 307	15 - 321	
HTTEL50	1542	745985	1 - 196	15 - 210	
HTTEU68	1543	967819	1 - 1207	15 - 1221	AA134604, AA187575, T75572, AA083163, W42892, A1092672, T97891, Z44468, R34642, R14267, A1078644, AA354837, R48102, AA362636, R55924, AA497072, AA044159, AW377397, R17450, T78498, AA625142, R56338, AA258076, and R99732.
HTTEV62	1544	573614	1 - 272	15 - 286	A1828837, A1015418, and AA953392.
HTTEY64	1545	974107	1 - 450	15 - 464	
HTTEY67	1546	917903	1 - 1523	15 - 1537	A1869330, AW295435, A1208233, AA447451, AA844516, AA664002, N40294, W04890, A1925298, AA903925, AA447450, AW243978, H14692, H14587, AA360639, and AA732693.
HTTEZ34	1547	771602	1 - 498	15 - 512	
HTTFA16	1548	870198	1 - 394	15 - 408	AA160412, and D78751.
HTTFB60	1549	869666	1 - 208	15 - 222	AW298813.
HTTFG35	1550	778426	1 - 254	15 - 268	AA581033.

HTTFG83	1551	974284	1 - 698	15 - 712	AA063114.
HTTFH70	1552	757358	1 - 342	15 - 356	H64973, AA659316, AA649530, AI636734, AA047057, AA664924, AA157876, AA046906, AI940546, AW028376, H57802, AA420703, AI306717, AA019793, AA385652, AA359194, AA713538, AA713930, AA639056, AA837006, AI679759, AA135988, AA084148, AW019964, AA908682, W27084, AA602458, AA083850, AI679486, C75332, H62123, AA338238, AA055647, W85818, AI634466, AI890283, AC003973, AC006263, AF196971, AC007793, AF039907, U80017, AL049779, AC006530, AL022238, Z83820, AP000221, AL136295, AF011889, AP000084, AL049709, AC006142, AF109907, AL022721, AC004617, AL049780, AL049831, AL020997, AC004462, AC006211, AL049761, Z83826, AL031255, AL024498, AL133216, AC005529, AC006030, AC000134, AC004999, AC004934, AC007390, AL139054, AF111167, AC002314, U85195, AL109758, I59642, L77570, AC005346, AC002492, Z83822, AC006261, AE000658, L39891, AC007993, AC006064, AC005969, AC006950, U91327, AC007664, AL049759, Z97180, Z98949, AC007462, AC005484, AF045555, AC005821, AC006581, AC004659, AC002039, AP000355, AL035684, AC007157, AP000552, AC012099, AF001549, AL022316, AC006162, Z98044, AC005874, AF134471, AC005179, AC005527, AC007688, AC003086, AL049697, AL109984, AL078584, AP000550, AL049760, AC006023, AC004996, AP000692, AC001231, AC007022, AC002040, AC009288, AC007066, AC004876, AC005730, AC008018, AC005320, AL022394, Z82198, AC004148, Z75890, AL023281, AC005037, AC008039, AC006273, AC005516, AC009248, AP000299, AL079342, AC007684, AB023049, AC005031, AC004686, AC002366, AL022398, AC004019, AC006960, AC006417, AC003048, AL031577, AF038458, AC006079, Z81364, D87675, AC002310, AC005740, AC004913, AL096701, AC003071, AC000003, AC004491, AC005744, AL035587, AC004253, AL050307, AC005180, AC001478, AL117351, AC004890, AL031848, AC006241, Z98051, AC003982, AP000114, AC005722, Z97056, AL031432, AL050318, AC006538, AC005089, AC004750, AL049713, AC002070, AL096761, AP000353, and AL133163.
HTTFK90	1553	787599	1 - 551	15 - 565	AI637920, AI657055, AA72352, AW316972, AI676064, AA904483, T11417, D59503, D81111, D80014, D58283, D58246, D80258, D80043, C14227, D80064, D80247, AA809122, D80251, C06015, AI535686, D80253, D58101, D59502, AA514184, C03092, C14407, D80366, AI557751, D80522, C14331, H67866, C14389, D50995, D59610, D51423, H67854, D80157, D80439, AA305578, D59859, D80166, C14014, F13647, D80195, D59467, D59619, D51022, D80210, D51799, D80391, D80164, D59275, D80240, D80038, D59787, D80227, AA305409, D80188, C14344, D81030, D45260, D80248, D50979, D81026, D80269, AW178893, D80212, D80268, D80196, D80219, D51759, D80241, D59927, D80024, C15076, AI557774, D51060, D57483, D59889, D80193, D80133, D80045, D80168, AA514186, AA514188, D60010, D80302, D51103, D80378, C14429, D59317, AW177440, C14298, C14973, C14957, D59627, D59653, AW360834, T03116, D51213, D51221, D59474, AI525917, C14046,

					C16955, AW360817, A1525920, AW377671, AW375405, AW360811, A1525235, D60214, C05695, C75259, D59551, D52291, AW178907, A1525227, AW178908, D59373, AW178906, AW378533, D45273, A1535959, AW360844, A1525923, AA285331, T03269, AW179328, D51079, D59695, D80949, T48593, AW375406, AW378534, AW179332, AW360841, AW377672, AW179023, AW178905, AW366296, AW177731, A1525912, A1525215, AW378528, AW178762, AW179019, A1525242, AW352170, AW378532, Z33452, T02974, AW352120, AW352117, A1525925, T03048, AW178914, AW378539, AW378542, Z21582, AW367950, AW360855, AW176467, C05763, AW378525, D80228, AW179020, AW378540, AW377676, AW352171, AW178774, AW177733, AW179024, AW179018, AW378543, A1525237, AW177505, AW178781, H67858, D51250, AW352163, D51053, C04682, AW177456, C13958, AW178911, C14077, A1525222, AW178775, T02868, AW178909, F13796, AW179004, AW179329, AW178980, AW177728, AW178986, AW178754, AW369651, AW352158, Z30160, A1535961, D31458, AW177734, AA305720, A1910186, N66429, AW177508, T11191, AW179009, AW179012, AW177497, AW177722, A1525928, A1525216, A1525228, D80654, AB028859, AJ132110, AF058696, A62300, AR018138, AR008278, A84916, A62298, A82595, AR060385, AR054175, I14842, AB002449, I50126, I50132, I50128, I50133, A70867, AR008277, AR008281, AR062872, AR016808, AR016514, X64588, X67155, Y17187, AR060138, A45456, Y17188, A94995, D26022, A26615, AR052274, A43192, Y12724, A63261, A43190, AR038669, A25909, A64136, A68321, AR066488, Y09669, AR066487, A67220, D89785, A78862, D34614, A30438, I79511, AR008443, X68127, AF123263, AR016691, AR016690, U46128, D88547, AR032065, D50010, AR008408, and AR060133.
HTTFL89	1554	974346	1 - 405	15 - 419	AC005551.
HTTFM17	1555	750942	1 - 430	15 - 444	AI457366, and AI023804.
HTTFM66	1556	950051	1 - 1145	15 - 1159	AA085574, AA490803, AA147472, A1239866, and AL049745.
HTTFS59	1557	825922	1 - 842	15 - 856	AA228367, AA176965, AA228376, AA004521, AA251249, R00504, AA303183, AW136898, AA448887, R00605, AA229970, H50956, AA345572, AA040486, AA004604, AA177117, AW247896, T74926, AA566080, and AF045584.
HTTFT08	1558	934460	1 - 441	15 - 455	AA301328, and H78684.
HTTFV93	1559	925544	1 - 393	15 - 407	AC006566.
HTTFW03	1560	923105	1 - 459	15 - 473	
HTTFX21	1561	924775	1 - 580	15 - 594	AI632236, A1279533, A1339379, A1806232, AA401419, A1356680, AW051296, A1096764, AA401395, AW008336, A1419077, A1423753, A1276550, A1435531, AW205745, AW104726, R60187, A1081767, AA830892, A1917002, A1806411, W03327, AW134602, H72137, H71911, H66942, H79399, AA507360, H66943, H81492, AA847135, H71435, H71434, A1824610, A1652697, AA829202, H72050, N32176, H71912, AA507323, H79288, R83711, AA886536, and A1652883.

HTTFZ70	1562	974066	1 - 357	15 - 371	AC004067.
HTTHH05	1563	931004	1 - 592	15 - 606	AC004067.
HTTHU43	1564	953479	1 - 1053	15 - 1067	AI278633, AA423847, AI276946, AI291687, AA262654, H22961, and AA255728.
HTTIG04	1565	926752	1 - 390	15 - 404	
HTTIH23	1566	869636	1 - 472	15 - 486	AW401826, AW408670, AA488824, and AB020677.
HTTIH80	1567	869635	1 - 328	15 - 342	AC006443.
HTTIL06	1568	934089	1 - 765	15 - 779	Z25007, AI758350, D80247, D50979, AA305578, C14389, D59275, D52291, D80195, D59502, D80164, D80193, D80439, D59467, D58283, AI525903, D80227, D81026, D80269, D59859, C15076, D80022, D51799, C14331, D80166, D80248, D80253, D81030, D59695, D51423, D59619, D80043, D80210, D80391, D80240, D80366, D80038, D59787, AA305409, C14014, D80212, D80188, D80196, D51022, D80045, D80522, D57483, D80219, D59627, D59927, H67858, D50995, D59610, AI525922, D51060, AA514188, D59889, D80024, D80302, D80268, D80133, D80378, D80251, D80168, D59474, D51103, C14298, AA514186, D80241, Z21582, D59317, D51213, D80157, T03116, D80258, AA809122, C75259, D80064, D31458, D59503, D45273, D59551, D59373, C06015, AI525914, F13647, H67854, C05695, C16955, T02974, C14077, T11417, T03048, H67866, D58246, AI525912, C03092, D80014, C14407, C14973, Z33452, C14227, T02868, AI535686, C14344, D52317, C13958, D51221, D81111, AI525907, C14957, Z30160, C14046, D51759, D59653, D45260, D58101, AI525242, AI557774, D60010, AI557751, AI525227, D51053, AI525235, AI525920, AI525917, N66429, AI525923, AA514184, AI525215, AI525216, AI525228, AI525238, AI525925, AI525237, AI525222, AI525969, AI535961, AR016808, AB028859, A84916, AJ132110, A62298, A62300, A82595, AR060385, AR008278, AR018138, AF058696, AB002449, X64588, I82448, I79511, I14842, AR054175, AR008277, AR008281, and AR060382.
HTTIN23	1569	869634	1 - 539	15 - 553	AC002549.
HTTIU05	1570	931015	1 - 573	15 - 587	
HTTIW81	1571	922817	1 - 434	15 - 448	
HTTIZ05	1572	930994	1 - 418	15 - 432	
HTTJA11	1573	839725	1 - 406	15 - 420	AI522185, and AI889003.
HTTJA47	1574	869618	1 - 417	15 - 431	
HTTJH13	1575	869615	1 - 297	15 - 311	AC004859.
HTTJM01	1576	913799	1 - 271	15 - 285	
HTTJQ06	1577	934130	1 - 397	15 - 411	AL046690, AL046714, AA301225, AW405562, AC005027, AL132774, AC005050, AC004409, AC006059, AC007785, AC004673, Z99496, AL033397, and AC002488.
HTTJX68	1578	974063	1 - 375	15 - 389	AL0231584.
HTTJY08	1579	958170	1 - 430	15 - 444	
HTTKD44	1580	948750	1 - 434	15 - 448	AA300492, R69716, AA377913, AA096018, and AC003688.

HTTKF89	1581	960928	1 - 411	15 - 425	AA301180, AA300961, and AL035425.
HTTKG34	1582	915033	1 - 378	15 - 392	
HTTKK06	1583	974311	1 - 584	15 - 598	
HTTKL80	1584	974316	1 - 464	15 - 478	
HTTKN21	1585	974310	1 - 504	15 - 518	
HTTKN30	1586	920893	1 - 487	15 - 501	N24270, AA355038, W16809, W76580, AA442492, AA394009, A1061614, AA306378, AW327292, N39773, AA431265, AA022944, W16892, H69650, W16816, N95146, AA437055, AA333960, N42264, AA471293, N39663, AA429690, AA287514, N28024, AA336844, AA337096, AA442618, AW298810, T81379, W20041, N25823, AA282421, A181314, A1038286, AA902825, A1093178, A1128035, AA092603, A1290898, D62144, N26891, AA846456, AA838697, AA640163, N40080, AA758626, W16976, AA939313, AW151976, N56324, AA927961, A1582147, A1223403, AA659796, A1348195, N26593, AA806403, AW118695, AA435600, A1187055, H60112, H98703, and AA022924.
HTTKP07	1587	911390	1 - 562	15 - 576	A1640500, AA035703, AF130247, and AF165138.
HTTKS13	1588	926795	1 - 470	15 - 484	
HTTKV17	1589	830008	1 - 416	15 - 430	AC005027.
HUDAM29	1590	529157	1 - 214	15 - 228	
HUDBZ78	1591	739638	1 - 366	15 - 380	A1799013, AW173341, AW072440, A1910986, AA620943, AA977595, AA913759, A1208578, and H56769.
HUKAA62	1592	503626	1 - 294	15 - 308	AA303037.
HUKAB80	1593	503445	1 - 335	15 - 349	AA300169, AA776941, and AC005841.
HUKAC72	1594	966804	1 - 296	15 - 310	AA300183, AW419202, H38334, A1124650, AA324325, H38499, AA299557, AA299817, AA663855, and M27444.
HUKAM82	1595	954420	1 - 309	15 - 323	AA299772, AA299548, and AA299549.
HUKAX07	1596	954359	1 - 258	15 - 272	AA299237, and AA299353.
HUKCC86	1597	529727	1 - 212	15 - 226	
HUKDH28	1598	531165	1 - 371	15 - 385	AC006035.
HUKDH50	1599	531163	1 - 315	15 - 329	AF064478, AB015355, AL034351, AC007529, AC005723, AC007684, AL020989, AC004448, AL008639, and AC002525.
HUKEH36	1600	531110	1 - 334	15 - 348	
HUKEH50	1601	531108	1 - 240	15 - 254	A1743421, A1807422, A1684708, AW104143, AA973066, AA843771, AA846889, AW135078, A1686018, and Z63492.
HUKEK55	1602	522213	1 - 546	15 - 560	A1085258, AA594171, AA731743, AA252492, A1866553, AW163561, A1028019, AA908826, A1479934, A1292039, A1701571, T32954, A1563944, AA987496, N91123, AA913053, AA748877, AA897110, T03349, AA903350, AA300185, A1268110, AA910894, A1199050,

HUKEO55	1603	714187	1 - 340	15 - 354	AI702521, T30992, D56255, R56442, Z45121, AA889837, W19847, AI559757, AW245526, AA905779, AA243398, AI871013, AL136295, and AF006264.
HUKES11	1604	967604	1 - 168	15 - 182	AI249880, AI312131, AI377805, AL080243, U63630, AC005722, AL023653, AL109865, AC004805, AC006146, AL022162, AC004675, AF088219, AC001226, AC007216, AC002472, AB001523, AC005568, AL049872, AL022324, AL034420, U95742, AL034548, AF053356, AC006084, AL049779, AC005231, AL121825, AC005939, and AC004955.
HUKFL69	1605	526819	1 - 352	15 - 366	
HUKFV41	1606	537530	1 - 289	15 - 303	AI830434.
HUKFX63	1607	946931	1 - 98	15 - 112	
HUNAD94	1608	575299	1 - 310	15 - 324	AA297031, AA298863, AA371410, AA837771, D51877, AI885465, AA077619, AA385775, AA297006, AW243808, F35684, T03928, H47368, AA599080, H79586, AA678472, AA632720, R83068, R92640, H85808, AW275432, AI223626, D51809, AI751191, AW028179, AA653291, AA187760, AI190648, H71738, AI525789, AI193417, AA584594, AI251034, AI254770, AI284543, AI054090, W39287, AI246061, H47736, AA445951, AI753365, R83708, H86399, AI510801, AI251284, AI251203, AI249853, AA788592, AI250552, AI985795, AW381198, AW381196, AL133238, AC008012, AC007363, U91325, AC004890, AL022394, AC002395, Z69733, AC004025, AL133249, AC005969, AC004865, Z99128, AC006197, AC008041, AC007666, AL118497, Z98880, AP000152, AC008033, AF049895, AC000052, AC007919, AP000567, AC004019, AL035454, AC000062, AL079342, AC002457, AC005740, Z82194, AC008123, AC002994, AL031311, U80460, AL122023, AL031114, AC007388, AF146191, AL035089, AC004081, AL049633, AF196969, AC006120, AL049843, AC009411, AL009175, AL135960, AJ131016, AL032821, AC007022, Z97832, AL109653, AL033403, AL022726, AL022151, AL117339, AC007551, AC004979, AC005722, AC005828, U96409, AL022319, AB001523, AC007312, AC007023, AL121825, AL031663, AC008009, AC000353, AC006928, AC002429, AC005509, AL022578, AC004802, AL020997, AL022718, AC006515, AC004020, AC005908, AL133244, AC006317, AC006039, AL049830, U85195, AC004746, Z93930, AL133312, AC007372, and AE000658.
HUVBB90	1609	503042	1 - 330	15 - 344	AA296418, AA296426, AA302599, AI223784, AI792577, AC005280, AC002287, AC004517, AL031592, AC000353, AL109847, AL034419, AC004993, AC004882, AL079342, AC005529, and Y18000.
HUVBB93	1610	502903	1 - 266	15 - 280	AA296425, and AL121603.
HUVBC12	1611	933023	1 - 353	15 - 367	AA296246, AA296176, and AA296416.
HUVCQ07	1612	928053	1 - 358	15 - 372	
HUVCQ55	1613	868795	1 - 372	15 - 386	AA296238.
HUVCS14	1614	914768	1 - 317	15 - 331	T84347.

HUVCU71	1615	968663	1 - 266	15 - 280	AC005410.
HUVCW62	1616	535361	1 - 386	15 - 400	AA296264.
HUVDDB28	1617	535006	1 - 265	15 - 279	AA714267, and AL078634.
HUVDDB53	1618	509119	1 - 339	15 - 353	AA296198.
HUVDIC15	1619	921088	1 - 490	15 - 504	AL031281.
HUVDDB09	1620	707061	1 - 178	15 - 192	AW378735.
HUVDIF13	1621	961020	1 - 297	15 - 311	
HUVDIF84	1622	526248	1 - 339	15 - 353	AC005319.
HUVDIF88	1623	522823	1 - 340	15 - 354	AB002339.
HUVDI28	1624	530558	1 - 463	15 - 477	H29210.
HUVDI76	1625	719332	1 - 286	15 - 300	
HUVDL30	1626	530387	1 - 96	15 - 110	AW367572, AW376975, AW376867, AW367596, A1248747, AW449393, and A1367533.
HUVD025	1627	679477	1 - 439	15 - 453	N80985, and AC004134.
HUVDP95	1628	530386	1 - 150	15 - 164	
HUVD526	1629	958027	1 - 590	15 - 604	AA435842, AA398811, and AC004111.
HUVDU51	1630	868660	1 - 279	15 - 293	AL009183.
HUVED35	1631	430750	1 - 732	15 - 746	AA166861, N56640, D59356, AB008681, and AP000500.
HUVED54	1632	534783	1 - 376	15 - 390	AL035405.
HUVED65	1633	527937	1 - 151	15 - 165	
HUVEN50	1634	530094	1 - 96	15 - 110	AF118069.
HUVEA55	1635	868779	1 - 515	15 - 529	AI460185, and AW270646.
HUVFB48	1636	967815	1 - 330	15 - 344	AA161447, AI583468, AA715433, AA630672, AW341978, AW021951, AI865278, R65651, AA640053, H63170, AA743445, AI500453, AI253987, AA094320, AA482273, AL046777, AC006121, AP000513, AC002477, AC007308, AL022323, AL022237, AL049760, AF124523, AC005480, AC006480, AC004686, AC007227, AC005015, AC006080, AP000030, AC002375, AC002550, AL021808, AP000023, AP001052, AL133163, AC006530, AL049780, AL035422, AL035252, AC007637, AC007226, AL023284, Z93017, AL031311, AC004217, AL031276, AC002470, AC006511, AC002425, Z85987, AC005280, AF165926, AF001549, AC004098, AC008033, AL031055, AF030453, U95740, AC007066, AL109984, AL137191, AL031295, AC005088, AC005736, AF001552, AC005701, AC004491, AL049871, AF109907, AC006312, AC004890, AJ009610, AC004019, Z84487, AC016027, AC004526, AL133246, AC006115, AP001060, AP000031, AC006057, AC006316, AC006023, AL079304, U95743, AF196970, AC005071, AC007999, AC004887, AC005057, AL031281, AC005484, AC003969, AC005839, AC003101, AC006013, AL021937, AL133448, AC007738, AC004983, AC002531, U82828, AC004782, AC006014, AC002525, AC002073, AC005189, AC006160, AC004859, AC007421,

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HUVFB69	1637	868782	1 - 558	15 - 572	<p>AA077619, AI620756, AW068786, AA547979, AI613285, AA613225, AL039761, H57324, AI018726, F33126, AW007980, AA804334, AI732789, AI821355, AA721572, AL037777, AI383965, AI364836, T63368, AW406046, AA558488, N77307, AL038005, AA515733, AA663063, AW029515, H47719, AI557422, R19998, AI376406, AW008161, AI963183, AI624421, AW243945, R97239, AA831638, AI017733, AA017334, AI240919, AI682310, AA862014, AI308598, AA584207, AA032020, AA297789, AA086257, AA493497, AI672931, AA523695, AI053784, AI926656, AW068580, AA599532, R14787, AI694784, AA662905, H22767, R99944, AA565319, R85174, AI816058, AA301899, AA364150, AI472782, AA588353, AA935380, AW029251, AA573051, AA487152, AA225548, AL047645, AA526413, AI581277, AA773042, AI336771, AC003982, AC005412, AC005535, AF042484, AP000045, AL121652, AC005006, AL035413, AP000356, AC005899, AL031984, AC003070, U91321, AL121603, Z84496, AC005730, AC004832, AC006316, AC007637, AJ239325, AL078459, AF196969, AF196972, AC005057, AC007676, L81772, AC002107, AC002106, AC004042, AL050307, AC009247, AC006515, AC004983, Z83838, AC001643, AC002319, AL049743, AL022320, AL035659, AL096791, AL049856, AL049692, AC003037, AL049849, AC002351, AC005225, AC008064, AC002365, X82877, AC006463, AL034417, AF029308, AC007792, AP000333, AL031602, AP000173, AL121655, AC005549, AC004774, AC002299, AC004125, AC002072, AP000066, AC006536, Z82179, AC005519, AC009516, Z99716, AF024534, AC005379, AC004084, AC006006, AC003685, AL034379, AC004671, AC005751, AC007686, AC005071, AL109798, AL031593, AC005625, AC006163, AC003030, AJ239318, AC002126, AF038458, AC005841, AP000114, AP000510, AC004079, AC004263, AL049911, AC005393, AC004841, AL021578, AC007226, AC005828, AC006948, AC005874, AF134471, AC008041, AC007773, AC005500, AC004025, AC002394, U72787, AF015416, Z93023, AL034395.</p>

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HUVFC07	1638	952080	1 - 474	15 - 488	AI338539.
HUVFH03	1639	922064	1 - 350	15 - 364	
HUVFH32	1640	934003	1 - 316	15 - 330	
HUVFI03	1641	868776	1 - 162	15 - 176	
HUVFK11	1642	965765	1 - 425	15 - 439	AA449997, AI653493, AA654979, AI828405, AI275183, AW242031, AI754037, AA297496, AA557982, AI471691, H90844, AA501554, AI291124, AI146750, AI821881, AI821918, AA640430, AC004797, AL050318, AC007283, AC005274, AC004150, AC006449, AL031295, AC005412, AP000692, AC006509, AL031427, AC004148, AC005233, AC004098, AL050348, AC006111, AC005015, AC000025, Z93023, AL109627, AC000041, AC007191, AF053356, AC002563, AL031729, AL009181, AC004645, AL049539, AL035458, AC005969, AC007225, AC005907, AL008718, AC004531, AC004675, AL133448, AF181897, AC004966, AC003026, AL117352, AL096701, AC005940, AL121653, AL022476, AP001053, AL008630, AC006241, AP000052, AC005736, AC004647, Z83826, AL049697, Z85986, AC006023, AC007536, U91323, AC005527, AC007688, AL020993, AC005578, AF207550, AC005175, Z95115, AC004821, AC005972, AC005632, AC007731, AC006285, AF205588, AL049759, AC007386, AC005500, AP000344, U63721, AL139054, AP000114, AL049829, AC002059, AL049843, AC002470, AC007308, AC009516, AL117344, AL034400, AC007541, Z99495, AL035249, AC004134, AC004408, AL096791, AC016025, AC002045, AL117337, AJ003147, AC002369, AP001054, AL133396, AC008040, U95740, AC006480, AC006965, AC004073, AL049766, AL031587, AC007395, AC006057, AL049569, AC005519, AC005004, AC002477, AP000689, AC004854, AC007160, AC005529, U47924, AC004913, AL035072, AC004099, AL049650, AC000118, AL031984, AC004895, AC005057, AC005409, AC004814, AL049712, AC007919, L78833, U91326, AC006275, AC004752, AC002350, AC005411, AL049839, Z83844, AF111167, AC008372, AF001552, AC006441, AC007787, AL110502, AC003093, AC006960, AC016830, AC004583, AC006064, AL133485, AL008719, AC004874, U82828, AP001052, AC007193, AC005037, AF200465, AC009509, AC007686, AC004686, AL024498, AI016897, AC002310, AC005031, AL031733, AC003104, AC004791, AC020663, Z95116, AC005261, AF196972, AL117339, AC005377, AC005954, AC007011, AC004491, AL035587, AL022316, AL122020, AL034420, U91321, Z93020, AC002073, AP000167, AC006930, AC006071.

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HUVFK58	1643	868784	1 - 772	15 - 786		AI797913, AA699643, AI583734, and AA010369.
HUVFL71	1644	958059	1 - 523	15 - 537		
HUVFQ03	1645	922727	1 - 457	15 - 471		
HUVFR02	1646	918233	1 - 564	15 - 578		AA076812, F12628, R10205, AA331552, AI752258, R86677, and T74459.
HUVFT28	1647	870617	1 - 829	15 - 843		R06515, and AC008116.
HUVFT50	1648	868769	1 - 357	15 - 371		AW303494, and AB032978.
HUVFZ06	1649	933942	1 - 408	15 - 422		
HUVGZ77	1650	909169	1 - 370	15 - 384		AI942325, AI672318, AI672319, and AB011665.
HUVHB35	1651	868751	1 - 342	15 - 356		AC005683, and AF172277.
HUVHB59	1652	963129	1 - 388	15 - 402		H98236, and AC005940.
HUVHC93	1653	908555	1 - 404	15 - 418		AA412491, AA412659, AA669386, T93130, T91516, and AB023189.
HUVHD88	1654	868697	1 - 145	15 - 159		AA658406, AA584733, AL038606, AW189113, AI524360, AI589230, AC006512, AC002994, AC003663, AC006312, AP000104, AC005907, AL109956, AP000272, AC007242, AC006050, AC005632, AC004675, AP000359, AF088219, U91322, AC003051, and AC005952.
HUVHG80	1655	968507	1 - 375	15 - 389		AC002076.
HUVHI07	1656	952090	1 - 508	15 - 522		AA551131.
HUVHO40	1657	924621	1 - 473	15 - 487		AA120795, AJ003560, AA358990, AW373532, AB014585, AL096767, AC004527, and AC006557.
HUVHU74	1658	868649	1 - 348	15 - 362		Z98036.
HVCAZ38	1659	969208	1 - 1151	15 - 1165		AA477501, AA479873, AI003611, AW270619, AI755214, AI754567, AA584489, AI754105, AI783911, AI962030, AA904275, AI620585, AI570943, AA779783, AA262752, AA013168, AW277253, AW438856, AL079734, AA582554, AA535216, AA019973, AI491765, AI872216, AW439703, D26361, AP000493, AC007938, AC004019, AC006210, AC003957, U47924, AF106564, AC005529, AC006077, AL031311, AF038458, AC006312, AC005578, AC000052, AL031680, AC004150, AF196779, AC005694, AC007666, AC005295, AC004895, AC005368, Z93023, AC005755, AC006006, AF053356, AC005682, AC005972, AC005306, Z82172, AC005231, AC005081, AC007435, AC004972, U62293, Z83844, AC004973, Y18000, AF207550, AL035361, AL050306, AC004263, AL121655, AC004686, AC004999, AC004812, AL049766, AL078587, AP000152, AP000502, AC010206, AB015355, Z99755, AP000501, AL121603, AC003006, AL034402, AF111169, AC005225, AC005399, AL034429, AP001053,

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HVCBV04	1660	925844	1 - 618	15 - 632	
HVCC081	1661	933449	1 - 49	15 - 63	
HVCC04	1662	925796	1 - 903	15 - 917	AA130954, AI826639, AA149522, AI625572, AI452441, AI653591, AI305234, AI433556, AI366037, AI076932, W60508, AI298406, AW249838, AA693895, AA932571, AI248312, AW136383, AI420053, AW250502, AI216563, AA678309, AA426066, AA937788, F31582, AA340275, AA204645, R11867, AI570112, AI692968, R60411, AI000109, AA130824, AA207010, W56198, AW382487, AW382451, AW392670, AW372827, AW363220, AW384394, AL119443, Z99396, AL119391, AL119497, U46351, U46349, AL119483, AL119319, U46347, AL119484, AL119363, AL119457, U46346, U46350, AL119324, AL042965, AL119444, AL119355, AL119396, AL119439, U46341, AL119341, AL119335, AL119522, AL119418, AL119464, AR066494, A81671, AR069079, AR060234, AR054110, and AB026436.
HVVAC41	1663	949141	1 - 259	15 - 273	
HVVAJ01	1664	914354	1 - 479	15 - 493	
HVVAJ06	1665	933675	1 - 375	15 - 389	
HVVBG19	1666	968967	1 - 541	15 - 555	
HVVBK45	1667	964102	1 - 1441	15 - 1455	AI751508, AW439242, AI858347, AA954665, AW173684, AA639199, AI633169, AW304822, AI828611, AI088904, AI923258, AI635118, AI952782, AI683485, AI635010, AI963627, AI278264, AW129973, AI860650, AI373090, AA642700, AI860395, AI982534, AI637577,

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HVVBK72	1668	933167	1 - 967	15 - 981	AW367808, AI016826, and AL135700.
HVVBY44	1669	917559	1 - 228	15 - 242	
HVVCO01	1670	913996	1 - 659	15 - 673	
HWLHJ68	1671	957834	1 - 1601	15 - 1615	AW364014, AW364012, AW364015, AW364019, AI760785, AI384093, AI224905, AA282933, AI267509, AA513728, AA729606, R80458, N76465, N59362, AA334630, AA3300682, R69849, R80659, AA573139, H86676, AA427982, AI499874, R31977, AI351352, D61921, AI091339, AA310325, AI051323, AA830587, N67319, AA449856, AA621436, N93060, AW134482, AI694673, AI161320, AI623166, AI582177, AW241458, AA648966, AA724337, and AB033047.
HVVDY04	1672	925793	1 - 286	15 - 300	AA811233.
HVVBY08	1673	957658	1 - 608	15 - 622	AA481033, AI352156, AA845263, AA918987, AA534490, AW089740, AI718613, AA845628, AA609823, AI369407, AA631989, AI669939, AI310130, AW007165, AA609822, AI620598, AI310317, AI718649, AI693036, AI168639, AI004446, AI253744, AW081227, AW005641, AI097314, AW235502, AA738077, AI440490, AA481085, AI198174, AA121509, AI018313, AI167316, AA601606, AI092025, AA989671, AA705106, AA402875, AA532756, AA872342, AW081239, AW081228, AA953907, AA215299, AA588197, AW262214, AA975943, AA580166, AW405706, AI915786, AI762484, AI081256, AA927941, AI698971, AA927751, AW009088, AA524140, AI695474, AI364551, AA214505, AA722938, AA923824, AI240069, AA631636, AI468059, AA358257, AA743585, AA382416, AA233136, AA729480, AA595320, AL119399, AL119511, AL119457, AL042544, AL119324, AL042382, AL043152, AL079794, AL043168, AL134524, AL037081, AA865126, AL042866, AL120853, AW051212, AI637584, AI433157, AI702073, AL079741, AI591420, AI493567, AW051088, AW168828, AI590575, AW169132, AI673363, AI610690, AI352497, AI698391, AI889189, AI633125, AI915291,

AW152182, AI431323, AI862139, AW078729, AI002285, AI932794, AW173633, AW198090, AW192652, AL121007, AI679672, AL046052, AI697207, AI538564, AL046931, AW090550, AI560679, AI884318, AW268964, AI670009, AW264019, AW075936, AI819326, AW006302, AW051258, AI818683, AI783792, AI612852, AI358213, AW129230, AI610671, AI630877, AI921464, AW080746, AI312542, AI890838, AI040725, AL119791, AI473536, AA748343, AI912356, AW168788, AI571439, AI802542, AI922561, AI815855, AI471429, AI570807, AL037582, AL046595, AI866469, AI037602, AI288050, AI635287, AW026882, AW168031, AI684234, AI559619, AI499963, AI564719, AI951868, AI095119, AI669639, AI890223, AW004886, AI589428, AW169604, AI590021, AI432969, AW078710, AI688858, AW239367, AW079572, AI270183, AI687362, AI499285, AI653979, AI620015, AI522052, AI624693, AI470674, AI677796, AL040207, AI619502, AI978703, AA740450, AI923124, AI682971, AI887396, AW087445, AI284084, AW118417, AI564259, AW148363, AI801766, AW075669, AW074172, AW088628, AW081298, AI469532, AI872423, AI909661, AI640729, AI283760, AI866770, AW190194, AI679550, AI812015, AI923370, W74529, AI690748, AI613038, AW192687, AI648684, AI539771, AI446809, AI870192, AI538850, AI871697, AI580190, AW129659, AI249877, AI432030, AW083778, AI348914, AI452560, AI926790, AA641818, AI499890, AI890833, AI677646, AI815232, AW081343, AW193020, AI679098, AI241923, AI587606, AW131294, AW167021, AI954183, AW148408, AI799183, AI357940, AA835966, AC005258, AF182293, Z63483, U77594, Y11587, X65873, X60786, L13297, I89947, AL137271, AF177401, L10353, AF061981, AF113694, U00763, AL080159, X52128, A08910, A08909, I48978, AR038854, I30339, I30334, AL137480, AF111851, AF153205, Z82022, AL137459, AL050149, AL050277, AF139986, A77033, A77035, AL137523, A08908, AF031147, Y09972, I46765, A08916, A08913, U35846, AF067790, AF126247, AL049347, AF111112, AR060234, AF031903, AL049430, AF182215, AL137281, I09499, E05822, AL080110, AL117583, AF090886, AL137533, AL050366, S63521, AL137478, U42766, M92439, AI8788, AF000167, A76335, AF183393, E06743, AL137479, X70685, AF151109, AF085809, AR053103, A65341, AL133557, AF026816, AL137463, AL133093, AF001215, AF111849, AL122100, AF090900, AL080148, A08912, AL137539, X98066, I89931, AL049283, A3000937, AL133075, AL133568, AF104032, I49625, X82434, AI8777, AF097996, AL117416, A45787, AF180525, AL133665, S7771, I00734, AL133560, I48979, A57389, AL137526, Y16645, Z37987, U66274, E00617, E00717, E00778, AL133113, AR020905, AF113019, AF113699, AL110221, M27260, U88966, AR066494, AL110158, AJ003118, AF158248, AL110225, AF004162, AL137550, AL137488, AF114168, AF100931, U90884, X84990, AF017790, AL137529, Y14314, AL080156, AF090901, AF030513, AL050138, AL137476, L04849, AL133637, AF067728, AL133558, Y10936, I33392, AF090903, AL096744, U01145, AL117440, AL096751, AL117435, AL133565, AF032666, Z97214, AF081197, AF081195,				
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HVVBM06	1674	933528	1 - 466	15 - 480	AI685069, AI378607, AI126015, AI129820, AA912338, AI367538, AW192295, AA495868, and AI738723.
HUVHL82	1675	912011	1 - 567	15 - 581	AI761350, AF039240, AI352375, AI206857, T25311, AW291067, AI090441, T25310, W39573, and AC004596.
HUVHI06	1676	952479	1 - 2268	15 - 2282	AW188421, AI810011, AW241649, N51726, AA449707, AI275102, N66707, AI299870, AI805173, AA448561, D82294, AW002169, AA523264, AW450305, N33880, AI929539, AI888456, AA912441, N25245, AA909431, H13878, AI362098, H17359, AW020771, AA858024, AA954574, AA012893, H17330, H08372, H08373, N51811, H08249, H40727, AA828659, H08148, Z45445, AA447120, AA828725, AA354903, AA736863, Z41152, AA172308, AA247943, AA581242, AA019451, H13835, AA336350, AA171992, T16753, AA337210, AI160120, AA854342, AA935605, AW086477, AI242421, T49472, AI471813, AI803581, AI301683, AI287719, AI803133, AI752956, AA996171, AI983147, AA136130, AA906744, AW136726, AA482550, AI363029, AA926759, AA448845, AA287077, AA910010, AA885946, AA906319, AA429360, AA969237, AI005339, AL037854, AW246747, AA808249, AI282196, AI276053, AA737505, AW015432, AI872692, AA166813, AW250179, AA773516, AI253632, AA670020, AI368453, AW275936, AA608627, AI263811, AI985149, AA833795, AA879424, AI886945, AL037427, AW026473, N25721, AW183174, AW082723, AL037853, AA553414, AI809312, AI186804, AI005449, AI986314, AI673381, AI017892, N48321, AI919513, AI468411, AA887602, W60356, AA169201, AI445179, AA554323, AA705759, AI686271, AI651379, AI742846, AA533769, AA702089, W45427, AA724285, AI391610, AA824443, AI352069, AI869500, AI420348, AA599184, AA744761, AL037220, AW079854, AA417981, AW337696, AI453528, AA372237, AI095475, AA127848, AI445148, AA581188, D82430, AI363934, AI860112, AA847002, AI743438, AI919040, AI469498, AA577316, H56183, AA640332, T03741, AA897496, T60053, AI827644, AI916823, AA715407.

HUVGP05	1677	930892	1 - 384	15 - 398	AA833676, AC006238, AF044670, and AF157497. AW293310, AI761633, AA721086, AA488897, H86783, AW296923, AA648257, AA906315, H84926, and AF091457. H15460.
HUVFP71	1678	950681	1 - 431	15 - 445	AA368455, AA861915, AA367693, AI000735, D31762, and AL049611.
HUVFI01	1679	945834	1 - 1366	15 - 1380	AA235432.
HUVFE03	1680	922889	1 - 692	15 - 706	
HUVDO18	1681	868783	1 - 299	15 - 313	AI003772, AW304257, AI624133, AW149036, W45510, AW328027, AW069137, AA375087, and D84488.
HUVDO11	1682	967813	1 - 263	15 - 277	
HUVDO07	1683	954224	1 - 301	15 - 315	
HUVDM27	1684	521938	1 - 342	15 - 356	AC004954, and AC004084.
HUVDH61	1685	526590	1 - 331	15 - 345	AA664604, AA568204, AA570740, AA483606, AI446623, AA315361, AL042373, AI569510, H91062, AA449669, W03333, AI801505, N55515, AA603413, AI889579, AI431513, R51582, AI300054, AI253376, AI278089, AW236163, AI356440, AA916177, AA757426, AA130647, AI754170, AI536834, AA513846, AW069412, AA326824, AI627614, T73016, AI284595, AA745470, AA084609, AW406659, AI583106, AI635609, AA401963, AC006129, AJ236701, M87914, S42653, AC006251, AC005368, U62317, AL035587, U96629, AF095725, AC005261, AL080242, AC006468, AC005747, AC005520, AC007283, U80017, AC005585, AL021977, AC007193, AC006449, AC005940, AL022336, AL031283, AC006312, AL031602, AC004999, AC002544, AC002400, AP000240, Z98941, Z94802, AL035458, AC004491, AC006276, Z98051, AL022165, AC005722, AL031311, AJ011930, AC006064, AC003688, AC005484, AC004814, AC006111, AC004757, AC003080, AP000555, AL031848, U62293, AC000353, AC004815, AC004890, AL135744, AC006071, AC005839, U91318, AC002310, AC005531, AC007510, AC005086, AC004922, AC004797, AJ246003, AC006285, AC006126, AL022311, AC006088, U91325, AL031228, AC002996, AC004593, AC000354, AC005412, Z82248, AC002044, Z84466, AC002418, AL121658, Z98742, AC000086, AL049779, AP000065, Z96811, AC005971, Z98304, AC004832, AC005057, AC004386, AF023268, AC002472, U95742, AC002347, AL035659, Z99943, AC005746, AL121653, U50871, AC005702, AP000156, AC005212, AC004659, AC002316, AP001053, AC007292, AL034555, AP000096, AC005519, AC007225, Z84480, AC003109, AL031775, AC007216, AC004881, AJ003147, AF121781, AC002286, AL021453, AL022320, AC007421, AB022537, AC007707, AF064861, S79349, AL079340, AC002366, AP000014, AC006501, AF124523, AC002115, AC002059, U52112, AL031591, AP000696, Z95115, AP000053, AP000121, AC003966, AC006130, AC006343, AC000026, AC005823, U33956, AC004106, AL109827, AC005280, AI080243, AP000251, AC004821, U91326, AP000355, AC009247, AC005031, AC006020, AL022316, AC005480, AL021579, AC005529, AF196972, AC005763, AC007363, AC002314, AC002430.

HUVCU26	1686	974232	1 - 688	15 - 702	Z97630, AC010582, AL050318, AP000695, AP000553, AC009516, AL035086, AC006039, AC004656, AF045555, AC005190, AC005081, AL020997, AC004983, AC002094, Z97181, Z98749, AC007384, AC004912, AC004963, AC002511, AL049761, AC000378, AF031078, AL031681, Z83826, AC004644, AC004448, AP000353, AL021707, AL049843, AC004531, AC005666, AC007842, U95739, AC000025, Z68128, AF030876, AC002350, AC007263, AL024507, AC004760, AC002073, AP000030, AC005696, AP000501, AC006001, AC016027, AL050321, AC005527, AP000362, Z99716, AC003963, AC003007, AC005014, U07561, AP000356, AL031597, AC004883, AC004699, AP000168, AC005512, AC005089, AL049569, AP000326, AB001523, AC005015, AC005391, and AC006388.
HUVCU26	1686	974232	1 - 688	15 - 702	AC005342.
HUVCU76	1687	522660	1 - 133	15 - 147	
HUVBC21	1688	671479	1 - 702	15 - 716	AI629014, AI015875, AA020867, AA020818, W15455, AI392776, W39642, AI248691, AI022556, AA296410, AA017442, R02316, and AF088026.
HUVA46	1689	667943	1 - 603	15 - 617	AA302686, AA302685, AA704009, AA568204, AA570740, AA483606, AI870453, AI720968, AW078909, AA550850, R55078, AA829036, AA719073, AW089322, AA484892, AA488746, AA935409, AI340151, AA676592, AI174456, AA320149, AL035400, AC007221, AC007425, AL020995, AC005015, AC007731, AC005500, AC004650, AC007308, AC005274, AC002470, L77570, AC002477, AL133500, AC005696, AC005280, AC012384, AJ251973, AC007055, AL096701, AC005722, AC004067, AC004000, AL109963, AC005088, AL117330, AL133353, AC005740, AC005081, AC002287, AC002070, AP000128, AP000206, U85195, L78810, AL132777, AL022323, AC006160, AC010170, AC005921, U91321, AC004913, AC004382, AP000245, AL132987, AC003108, AE000658, Z93020, U91323, AC004832, AC005919, AL117344, U91322, AB023048, AL031276, AL030996, AC004966, AL050318, AC007676, AC005484, AC006480, U95740, AL121653, AC005529, AC007052, AC004876, AL050332, AC005844, AC005874, AF134471, AC003029, AL031281, AC002302, Z83844, AP000049, AP000116, AF001548, AC002299, AP000553, AC005971, U91326, AL133245, AL121603, AC006344, AC007172, AL021391, AC005527, AL021807, AC005005, AP000311, AL020997, AC002059, AC006538, AL031588, AC002369, AC006511, AL035079, AC006057, AC005071, AC005200, Z95116, AF045555, AC002544, AC006277, AC007637, Z93930, AC002350, AC007546, AC004967, AC004878, AL031594, Z93023, AC006023, AL049569, AL133448, AC004491, U80017, AC005011, AC008015, AL033527, AL049761, AL049760, AF190465, AC007011, AB023049, AP000008, AC007934, AL035422, AC005102, AC005821, AC007371, AL109802, Z98051, AP000704, AC005225, AC006208, Z85986, AL035683, AL031289, AC007041, AC005920, AC000052, U62293, AC004531, AP000692, AF196969, AP000121, AC006312, AL034429, AC006254, AF111169, AC007030, AC005906, AF109907, AC005324, AL133382, Z86090, AL049776, AC008018, AL008716, AL022316, AC003663, AP000552.

						AC004477, AC004883, AC004841, AC002326, AL096706, AL031432, AC005796, AC000353, AC000378, AF053356, AC004953, AL139054, AL117337, AC005399, AL050348, AC005606, AC005231, AC004019, AC005562, AC005335, AC005332, AF047825, AC002559, AC006468, AL122003, AL031279, AP000115, AC006449, AP000031, AC007057, AL031602, AL035405, AL021154, AP001053, AC007225, AC004998, AC005664, AC009516, AC005881, and AC005184.
HUNAK12	1690	839574	1 - 421	15 - 435		AA757367, AA296644, and AC006327.
HUNAG41	1691	711543	1 - 473	15 - 487		R19731, H08375, H06407, R54527, A1654477, AA298292, and A1683415.
HUNAF22	1692	800452	1 - 422	15 - 436		AA298987, and AC006222.
HUNAF20	1693	961527	1 - 467	15 - 481		AA528216, A1347038, A1308941, AA583432, AA412292, A1147693, AA632915, AA836857, AA018749, AA135185, AA516435, AA916348, AA514541, N62509, AA470014, A1350971, R42401, H17978, AA299011, A1207239, AA349833, AA494556, F12523, AA290708, and AF184971.
HUNAE95	1694	796691	1 - 411	15 - 425		R68794, T89302, R64326, R78900, AA299021, AW021631, R26617, and A1820562.
HUNAE76	1695	524239	1 - 308	15 - 322		AA298749, AW078909, AA742815, AA557686, AC004132, AC008372, AL022238, AC006430, AC005011, AC005899, AC002351, AF001549, AC004821, AL035420, AC006441, M89651, AC005746, AJ003147, AL031276, AC005969, AL009031, AC002326, U91318, AC004837, AC000387, AL034423, Z15025, AC003101, AC005037, AC005184, AC004526, AC018633, AP000215, AL031295, AL008718, and AP000502.
HUNAE02	1696	921132	1 - 429	15 - 443		AA502008, AA298860, N59191, A1559794, A1218041, A1805928, N59181, AW188364, AA470022, H29622, A1216757, A1015520, A1202594, AA458483, AA565254, AA883777, N89710, AW340697, A1288448, AA588588, A1344556, A1248194, A1469895, A1954555, R89606, A1149444, AA505427, AW118040, AA886990, N30779, AW206450, A1800674, AA343608, A1761704, AA514300, AA581058, and AF151848.
HUNAD10	1697	968590	1 - 479	15 - 493		AA258009, AA299129, C02926, N85987, AA630672, A1499588, AW023990, A1636730, AW196064, AA380354, AA588001, A1818231, A1745151, AL045808, AL046156, AW341978, AA903253, AA515457, AA308716, AA575911, AA532700, A1494539, A1537772, AL046266, C15060, AA715201, N53062, AA370455, A1524360, AA487621, A1754544, N94065, AA488746, A1355556, N23504, AA480574, R73754, AW081194, AA531580, AL138182, AA618452, W47183, AA580808, AA345064, H69765, F00440, A1684097, A1817516, AA559241, A1908575, AL119724, R43288, AA833896, AA833875, H12383, AA402129, AA502991, A1306232, R65651, AA806762, AA604840, AW089322, A1174891, A1002744, AA463590, AA476397, AA719073, A1623423, H78032, AW085718, AC012627, AL020903, Z93017, AF052041, U78308, AF095725, AL121655, AL049631, Z99128, AL035415, AL035652, AC005377, AF111169, AF003529, AL096766, A1246003, Z95152, AL009179, AC006353, AL117355, AL121653, AC004655, AC005037, AC006059, AL031279, AL031289,

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HUNAC68	1698	753817	1 - 190	15 - 204	AA299084, AW058660, R79123, and AI955484.
HUNAB76	1699	968754	1 - 457	15 - 471	T78720, T85868, and AA299178.
HUNAB42	1700	714264	1 - 278	15 - 292	AA299202, AW382627, and W69280.
HUKFS69	1701	754186	1 - 276	15 - 290	N98250, and AL021068.
HUKFL89	1702	574525	1 - 457	15 - 471	AI027884, N90218, W56483, and W38946.
HUKFL71	1703	760581	1 - 227	15 - 241	AA348602, AW188860, T17332, AI634716, AA586433, AI049701, AI559282, AW238212, AA728938, AA806804, AI564301, AI002762, AI623364, AW068580, AI872000, AA531596, AW194077, AA758131, AW003612, AI365625, AI620266, AA720582, AA363003, AA628740, R61195, AA713705, AA626840, AA713714, T30418, AA827383, AI798242, AA179663, R49266, AW190484, AI075249, AI819262, N40092, AI188049, AA351808, AI475870, AA683091, AC006485, AL035422, AC005323, AJ003147, AL121754, AL035634, AL133371, AC007686, AC005180, AC002551, U07563, AL021578, AP000514, Z93241, AC005386,

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HUKFL52	1704	574523	1 - 482		15 - 496	AW303688, AC002302, and AL117325.
HUKFK53	1705	577349	1 - 436		15 - 450	
HUKFE36	1706	574381	1 - 213		15 - 227	W30961, and AA284307.
HUKFD95	1707	796014	1 - 446		15 - 460	AA259075, AA251698, and Z56473.
HUKEY01	1708	921504	1 - 333		15 - 347	AA913741, AI052134, AA838729, AA418342, AI368697, AA156454, AI275854, AI554346, AW193440, AA564981, AI274286, AA969728, AI920804, AI435811, AA410342, AI360949, W04701, N25790, AA115096, N23736, AA193407, N58849, AI858171, AA630452, AA649290, Z24907, AA757161, AA630461, AA780577, W15321, AI245223, AA363098, AI038657, AA860500, AA993680, AA435925, AI439836, AA651840, AA279471, AW338576, AA342107, AA676504, AA854457, N48087, AI539628, AI089644, AI095714, AI373864, AA639258, AI567507, AA432267, AA194632, AI280712, AA890333, AA890563, W72009, AI745574, N91475, N75263, C00067, AA302403, and AA431256.
HUKER62	1709	772501	1 - 547		15 - 561	RS1351, AA534218, AA580300, AI284322, H78278, AI610392, D52671, AA115034, AI299062, AA778315, W73534, AA393903, AI290762, AI521482, AA115506, AI439629, AI475831, AI688331, AA764845, AI285054, AA027198, AI344564, AA830343, AW103497, AA435644, AW152418, AI814349, AI953851, T87095, AA865531, AI937550, AI992099, AI492575, AI968561, AI990835, W46791, AI336624, W46919, AI380956, W73259, AI675500, AI685131, AA634802, AA482973, AI669123, AI973010, AI201952, AW262269, AI352386, AI470518, AI337432, AW274833, AI783962, AA987852, AI470225, AW083650, D61500, T33520, AI885985, T03350, AW150047, AA350468, Z38276, N26529, AI864257, N21584, R32096, AI372555, AI372554, H78277, AA045465, AW440715, AI620909, AA384495, AA046535,

HUKEP18	1710	957456	1 - 838	15 - 852	
					<p>AW015422, AI336885, Z69667, and AC004754.</p> <p>AA203189, AI057441, AW139922, AA719156, AI653844, AW104223, AI208345, AI535660, AI536138, T18597, D80045, AI535639, D59751, AI57262, C15076, D80164, AI557084, D59467, R29657, C14331, D80193, AI526078, AI525856, D81026, C14429, AI541365, D59787, AA585439, C14389, AI525556, AW366296, D80195, D80227, D59502, AI557533, AI525316, D50979, D81030, D59275, R45895, D80269, AI541205, D59927, D80022, D80188, D58283, C15406, D80166, D51799, D59859, D59619, AI525500, D80210, D80391, D80240, D51423, D80253, D80043, AI557864, D59610, AA305409, D80212, D80038, D80196, D80219, D57483, AI905856, D80366, D80378, D59889, D50995, AA585098, D52291, D80241, D80251, D80024, Z32887, AW177440, AI541356, AI557731, Z33559, D51022, AI557602, AA305578, AW375405, C14407, AW378532, R28735, R29445, D51060, D80522, R28967, D53161, D57491, T03269, AW178893, C14014, R28892, AA585378, AA585325, C75259, AA514188, AW179328, R28965, AI557155, AA585101, T11417, R29218, Z32822, D80248, D54897, D51250, AW369651, AI557751, AI541535, AA514186, AI541346, AI535686, D80134, AW352158, AI540903, D58253, AI557809, AI540974, AW375406, AW178762, AW178775, AW177501, AW177511, D80133, AA969188, D80258, AW176467, AW360811, D80268, C05695, D61185, AI557082, AA585356, D60765, F13647, D60844, C14077, AW352117, AI546829, AW377671, AI557408, AI910186, D80132, AW378540, D80302, AI526184, AW360844, AW360817, AW378534, AI541034, AW179332, AW377672, AW179023, AW178905, C06015, AI541517, C16294, T48593, AI546875, AI546999, AI557241, D80439, AW352171, Z21582, D59373, AW377676, AW178906, AW352170, AW179018, AI541321, AW179024, AW17731, AI557734, AI557317, D80247, AW178907, AW179019, D51213, D81111, AI557787, AW177505, AI546971, AW179020, AW360841, AW178909, D59627, AW177456, AW179329, D51103, AI557727, AW178980, AI557852, AW177733, AW378528, AW178908, AW178754, AI541374, AI526194, AW360834, AW352174, AI536070, AI546945, D80014, AW179004, AW179012, AF100707, A62298, A62300, A82595, A84916, AR018138, AR038855, Y17188, U87250, AR016808, AR062871, AJ132110, I19525, Y17187, AF058696, A25909, X67155, D26022, AR008278, AB028859, A67220, D89785, A78862, D34614, X82626, A94995, AR031365, D88547, I82448, Y12724, AB002449, AR025207, AF006072, U94592, AR016514, AR060385, A43190, A44171, AR031358, A30438, Z30183, X68127, AR008443, A82593, AB012117, AR050070, AR062872, AR038669, I50126, I50132, I50128, I50133, A85396, AR066482, AR066488, A85477, AR060138, A45456, A26615, AR052274, A86792, X93549, D50010, Y09669, A43192, AR025466, I14842, D13509, AR066490, AR066487, I18367, AB023656, D88507, AR054175, X76012, AR016691, AR016690, U46128, AR008277, AR008281, A63261, AR008408, A70867, AR017826, X82834, I79511, U79457, A64136, A68321, AR060133, AF135125, AF213384, AF123263, AB033111, AR032065, AR060382,</p>

HUKDY02	1711	920815					X93535, and AR008382.
HUKDU47	1712	719465	1 - 480	15 - 494			R54146, and W72450.
HUKDG10	1713	968333	1 - 367	15 - 381			H56528, and W27624.
HUKCP30	1714	690933	1 - 393	15 - 407			Z21273, and Z21324.
HUKCO11	1715	690933	1 - 296	15 - 310			R93336, AI364837, and AI871934.
HUKCL85	1716	967742	1 - 436	15 - 450			AW188043, AA743890, AA641852, AA654170, AA494552, and AA824490.
HUKCC25	1717	529718	1 - 336	15 - 350			
HUKCC15	1718	529723	1 - 246	15 - 260			
HUKAT59	1719	518537	1 - 112	15 - 126			
		628540	1 - 385	15 - 399			AA299333, AA299334, AA488225, AI761274, W39643, AA436997, H26851, R69372, AA442825, AA133785, R48022, N78459, AL046919, AI659107, AA922133, W15236, F02924, AA135871, AW242187, R45109, AI355457, AI937442, AI270750, AI869489, T16709, H04785, F02239, R36219, AA938012, AI540377, T30366, AA491517, AA897754, AA972881, AA902408, H19244, Z39481, AI627407, AA133786, AI720129, R56889, AI911499, AI334362, H16569, AI285897, AI362708, AI148478, AI890959, AI961584, AI625445, AA099547, AI864641, AA947105, AW295635, AW304383, AW183032, AA580304, AI338026, AA725780, AA701287, AI815089, AA910649, AA059396, H10768, R47916, AI613048, AI827547, AA488171, AI362313, R60948, AI351348, AI268730, R69373, AA932084, H17326, H75830, D56341, Z43600, and AA099546.
HUKAQ76	1720	502711	1 - 337	15 - 351			R02387, and AA299632.
HUKAO47	1721	502911	1 - 367	15 - 381			R08548, AI360159, AI445049, AA299487, and AA831602.
HUKAM19	1722	672076	1 - 315	15 - 329			AA299796, and AA299795.
HUKAM18	1723	502912	1 - 636	15 - 650			AA166965, AI143571, AI187051, AI633250, AW135626, AI468530, AI916114, AA299797, and AA299798.
HUKAL44	1724	716927	1 - 390	15 - 404			AA083174, AI344586, AA299808, and AI275232.
HUKAJ91	1725	790487	1 - 146	15 - 160			N89673, AA877587, N89666, AW275503, AA548632, AI433318, AI800226, AI913521, AW235557, AI033607, AI741530, AA299661, AW003738, AI431440, D59328, AF108205, AF106698, and U67321.
HUKAJ83	1726	524257	1 - 316	15 - 330			AA299762, AA299761, AA535406, AA063173, AA534010, M86120, AW069510, AA947547, AI281697, AA310158, F17891, AA584201, AI358431, AA552843, AI367975, AI754955, D51681, AA846952, N27763, AA367986, AA516226, AA866015, AA488746, D52044, AI653905, AA362349, R89904, AC004142, AL031846, AL031255, U78027, AI031577, AC005237, AC007308, AC004019, AC005578, AC000052, AC005971, AC007216, AC005703, AP000692, U95742, AI109984, AC005288, AF111168, AC005081, AP000115, AC004234, AI022313, AI020997, AP000553, AC006064, AC004876, AC004895, AI121653, AC005523, AC003695, AC009516, AF030453, AC005071, AI139054, AC006071, AC007536, AC005778,

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HUKAD77	1727	772734	1 - 409	15 - 423		H96061, AA300129, AI147406, AI189973, AA431411, and AI078297.
HUKAB63	1728	625273	1 - 195	- 15 - 209		AI079608, AI807065, AI952291, AI590123, AI090727, AI016788, AA456134, N20016, AA977594, AI970077, AW029554, AA635175, AI680564, AI474417, AW339144, AI933942, AW152328, AA149927, AA303069, AI864866, H98815, AW170581, AA699755, AI391578, AW009047, AI982927, AA576948, AA485634, AA428599, AI016186, AA824314, AA991678, AA910276, AA576748, AA479608, AA829399, AA398673, AA933886, AA922521, AA868264, AA620744, AA303070, AA662449, AA568243, AA211758, AA913101, AI161248, AI797204, AA644052, C06116, AI693943, AA476960, AI799459, AA160700, AI673693, AI890207, AA642505, AA526838, W86624, AI241307, AI969413, W57802, AA602638, AA922005, AA954133, AA514739, AA838009, AI890528, AA909312, AA620353, AI423401, AA884139, AA192820, AI918960, AW236180, AA463209, AA621214, AA574061, N29954, F33718, AA913537, AA777231, AA864549, AA432235, AA703595, AI148263, AA868797, AA788644, AI084525, AI024640, AA299468, and AL137631.
HUKAB25	1729	677470	1 - 461	15 - 475		AA303079, AA127017, AA702731, AA659016, AA316535, AA365415, AA304577, AA411655, AW170716, AI969252, AI264137, AI907629, AA603883, AW193546, AI120502, AW162022, AA016286, AA663086, AA661948, AA665330, AA663115, AI985942, AA640204, AI255015, AI255004, R10260, T89571, AA128969, AI053977, AI054418, AI343078, AW268322, W85860, AA976584, AA826177, AI708663, AI671052, AI719434, AA504355, AA443426, AI189872,

						AW419126, H21137, AA634238, AA218645, T62975, A1686563, F17700, AL045709, AA879430, AL031682, AC004963, AL008721, AL020995, AC005527, AC005529, AL049780, AP001052, AC004460, AC005274, AL031846, AC005245, AC007461, AC005730, AL109984, AF024533, AC005030, AL035071, AC004805, AC006596, AC005694, AL022316, Z82246, AL121825, AC002369, AJ229043, AL021920, AC005233, AC005874, AF134471, AC002456, AC004765, AB022430, AC005320, AC007055, AC006515, AC004645, AL022326, AC002565, AB020863, AC006065, AC004775, Z98946, AC006057, AC006142, AC005088, Z69648, AC005284, AC005837, AL079340, AC007666, and U89337.
HUKAA54	1730	503630	1 - 441		15 - 455	AA303097, AL022325, and AL031588.
HUKAA39	1731	503627	1 - 318		15 - 332	R58995, AW444583, A1139054, AA303128, A1422562, AW452316, AW136820, A1355998, A1871425, A1499766, and AC005789.
HUDBZ01	1732	869026	1 - 519		15 - 533	AC000070.
HUDBK39	1733	886368	1 - 474		15 - 488	N88782, N88601, AA247964, N84855, H58760, N83168, AA095359, N89520, N83991, AA096046, AA247827, N83992, N55698, N84048, AA095641, AA096066, N88518, N84718, N86694, N83993, N84712, AA471338, N84830, N87989, N84829, S78798, U48696, AF103726, AR066487, AF039698, AF045432, AF102850, AF032922, AJ243486, and U39066.
HUDBE95	1734	795796	1 - 316		15 - 330	
HUDBE64	1735	746508	1 - 348		15 - 362	
HUDBE48	1736	869034	1 - 423		15 - 437	AI651392, AI912649, AI690582, AA101690, H02616, AI139898, AA731894, AW269260, AW248051, C04885, AW137058, AI597917, R41929, AI401381, AI125561, AA394302, AI884475, AI913287, AI915152, AI753690, AA295249, AW088536, AI380436, AI632150, and AB020861.
HUDBE28	1737	686520	1 - 360		15 - 374	AI697533, AW204092, and AI963731.
HUDBE02	1738	917361	1 - 123		15 - 137	AA585476, T18597, R28735, R29445, R45895, R28967, AA170832, R29218, AA585325, N86592, R28895, AA283326, R28965, R28892, R29179, AA585098, R29657, R29177, C16293, AA585101, D61254, C16315, Z28355, AI546875, AI557734, AI557864, AI525306, D53472, C16300, D57491, D60844, R29262, R29172, Z32822, D60765, AI526140, AI546971, AI541365, AI557763, D59751, AI546999, AI547250, AA585439, AI557262, C15406, D53447, D54897, C15120, D53161, D52835, AI541383, AI541374, AI541356, D59436, D61185, C16292, AI557740, AA585155, D55233, Z32887, AI526184, AI546945, AI525500, AI525431, AI546921, C16305, C15069, D57186, AI541517, AI547006, C16294, C15762, AI540967, AA092643, C16290, T19407, AI526194, AI541205, AI541535, Z30131, AI526078, AI525316, AI541013, C15737, AI557731, AI526073, D60730, AI541523, AI557787, AA585356, AI546996, AI547039, AI526191, AI541307, AI525556, AI557758, C16296, AI557727, AI546891, T41289, C14208, AI526016, AI541346, AA174170, AI541527, AI525320, AA514191, AI557807, AI525339, C14723, C14322, C14391, T41329, AI547202, AI557264, AI557155, AI547196, AI557084,

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HUDAK54	1739	899753	1 - 822	15 - 836	AA247964, N88601, N89520, N88782, N84718, H58760, N84855, N83992, N83168, N83991, AA095359, AA247827, N84048, AA093224, AA096046, AA095641, AA096066, N83993, N86694, N84712, AA471338, N55698, N84830, N88518, N84829, AF154415, AF164678, AF165161, S78798, AF045432, AF103726, U48696, AF102850, AF039698, AR0666487, AF032922, AJ243486, and U39066.
HUDAK19	1740	671974	1 - 444	15 - 458	H16933, AA149496, and AA531296.
HTTKG12	1741	969547	1 - 461	15 - 475	AA172361, AI537800, AI791659, AW272815, AI355103, F23338, F34506, AI934307, AI246996, AI242614, AW407220, AL045476, H51835, AI869797, AA503258, AW238341, AI805261, F23327, AI587583, AI587565, AI720141, AI471455, AA808725, AI865980, AW151761, AA342238, AI246192, AA524800, AI927275, AW265688, AI281474, AL046416, AI687343, AW270619, AW023111, AW372037, R34070, AI310464, AI521525, C14014, AI539024, AA743811, AW069227, AA657835, AI801563, AA484892, AA947369, AA992877, AI249688, T71936, AA468923, AW020150, AI537368, N71619, H79308, AI280266, AA364082, AA218684, AA533463, AI251436, AA084320, AW302017, AA351840, AA610433, AA936718, AI858165, AA350644, AA904275, AA714011, AA298365, AW272389, AI445216, H59856, AW275719, AA719433, AA720582, AW104163, T07451, AL118980, AI880889, AA583386, AA550959, AA292234, AA018923, AI935827, AW419389, AA846923, R73744, AA128592, AL134441, AA714110, R56485, AA809104, AI821945, AI587349, AW439703, AI536625, AA533054, AI223968, AI568659, AA992126, F32248, AW274078, T39390, AI205181, AA630122, AI367473, T48723, AI024339, AA774794, AA632765, AC006511, AC005740, AC002059, U47924, AC002985, AL031985, AC006538, AC005102, AF196779, AI031281,

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HTTKC85	1742	956206	1 - 436	15 - 450	AI224604, AA279200, AA258999, and W37285.
HTTJV79	1743	869602	1 - 434	15 - 448	AA825972.
HTTJN26	1744	869612	1 - 891	15 - 905	AI356567, N90525, AA232991, AI148171, AI022165, AA233101, AA573721, AA448133, AI306380, AA447991, AA127550, AA127551, AW016855, AA243852, AI473237, AI005068, AA554071, AA570256, AA906902, AW014761, and AI359627.
HTTJK06	1745	934094	1 - 564	15 - 578	AA853292, AL117470, and AB023143.
HTTIX05	1746	931024	1 - 520	15 - 534	AI493098, AW024745, AA921917, W90789, and AI915946.

HTTIR33	1747	974323	1 - 341	15 - 355	AC004491, AL050307, AP000023, AC004884, AL078472, AL008715, AC007227, AC005180, and Z98304.
HTTIR04	1748	926772	1 - 557	15 - 571	AA083298, AA829975, and AB014535.
HTTIN11	1749	965920	1 - 801	15 - 815	AL133824, H86873, and H86809.
HTTIE08	1750	958169	1 - 427	15 - 441	AW052126, and AA101833.
HTTIB12	1751	969568	1 - 336	15 - 350	R92571.
HTTHJ56	1752	944914	1 - 258	15 - 272	D81382, AA193637, AA234876, T83136, H11688, AA258658, AA306506, and AA252212.
HTTFG12	1753	751809	1 - 359	15 - 373	AA169457, AA172190, and A1636076.
HTTEZ61	1754	742004	1 - 539	15 - 553	R13891, A1150008, and A1198021.
HTTEQ59	1755	739445	1 - 550	15 - 564	AA237056, AA491051, H78425, and R92491.
HTTEQ01	1756	917156	1 - 458	15 - 472	A1827837, A1142441, A1086379, AA813388, AA253028, H17296, AA613757, A1474835, and Z83845.
HTTEO59	1757	900662	1 - 148	15 - 162	
HTTEO53	1758	728344	1 - 763	15 - 777	W74401, Z45510, H79976, D81436, D53762, and D61200.
HTTEJ56	1759	573669	1 - 492	15 - 506	R54109, A1884701, Z39259, R41821, and AW075808.
HTTEB05	1760	932294	1 - 373	15 - 387	C74999, T90424, AB023197, and AL031672.
HTTDO59	1761	744438	1 - 734	15 - 748	R82651, R82700, AA372368, N79122, AA033606, A1546974, AL133016, AL122061, AB021868, AF034080, and AF032872.
HTTDM42	1762	460948	1 - 389	15 - 403	R95162, and H91087.
HTTDL81	1763	694222	1 - 392	15 - 406	AA485538, H74053, N43924, N43932, AA280231, AA613434, and AL022328.
HTTDL75	1764	766551	1 - 356	15 - 370	AA199666, AL120288, and H18766.
HTTDA85	1765	784537	1 - 408	15 - 422	N46977.
HTTCQ95	1766	796674	1 - 310	15 - 324	N57049, and AW078548.
HTTCJ39	1767	709581	1 - 469	15 - 483	AA012877, AA021074, AC007450, AC009533, and AC008013.
HTTCD06	1768	960599	1 - 483	15 - 497	R22892, R30952, AA767622, D80460, D60956, A1800613, D60394, A1750009, A1453046, C15178, R81201, and D59944.
HTTCB87	1769	524841	1 - 224	15 - 238	H80337, AA769820, R16729, A1091785, and AW273500.
HTTBR42	1770	714220	1 - 329	15 - 343	AA164855.
HTTBP62	1771	932997	1 - 601	15 - 615	AA341024, and AA249649.
HTTBO82	1772	780164	1 - 422	15 - 436	N59547.
HTTBM03	1773	925409	1 - 193	15 - 207	R96101, and AL050318.
HTTB180	1774	781590	1 - 229	15 - 243	AA256038, and AA768241.
HTTBH95	1775	530559	1 - 244	15 - 258	
HTTBH75	1776	767520	1 - 422	15 - 436	R21404, AC006987, and AF146191.
HTTBH36	1777	530567	1 - 299	15 - 313	

HTTAQ60	1778	742377	1 - 615	15 - 629	H73605, R92625, AA300822, and T77356.
HTTAP45	1779	717736	1 - 384	15 - 398	AA300727.
HTTAP21	1780	671488	1 - 802	15 - 816	W94307, W79130, AA300911, AL023803, and AF086439.
HTTAP09	1781	826343	1 - 427	15 - 441	AA189122, and AA300969.
HTTAN34	1782	509454	1 - 455	15 - 469	AA252276, AA227154, A1656990, AA301077, AA301076, AL042627, AC004593, AL023574, and AC007536.
HTTAJ93	1783	791413	1 - 406	15 - 420	R01464, AA300985, T87497, and Z75742.
HTTAH03	1784	965134	1 - 282	15 - 296	A1198425, A1480040, AW054766, A1564875, A1359129, A1359233, A1422375, A1651642, A1056060, AA301255, T82079, T84917, T85537, T86503, A1954689, A1962153, T92050, A1742287, AA421072, A1244008, AA379174, A1355598, H84990, AA045378, H86604, A1580336, AA731146, R99375, H86921, AA007586, AA128609, AA062583, T85467, AA453722, H55168, A1200967, AA383353, T10083, and AA919169.
HTTAC77	1785	772735	1 - 764	15 - 778	A1694695, AA913353, AW236100, AA846529, AW301152, N62629, A1366198, AA449338, AA694442, A1620459, W39523, A1521787, AA977228, AA600876, AA724335, AW078557, AA995242, AA860876, AW235851, W15410, AA456019, AA301436, AL122078, and AF198358.
HTTAA94	1786	793001	1 - 555	15 - 569	AA191546, W91892, AA486427, AA694339, AA416561, A1140707, AA417297, H77647, H77648, W95110, AA303182, T19870, H26488, and AL031255.
HTTAA39	1787	710355	1 - 284	15 - 298	A1800489, AW105035, A1480088, AW299975, AA303221, A1670831, and AA135748.
HTLIP06	1788	934207	1 - 330	15 - 344	A1820928, AA405805, A1821678, AA813084, AA410617, A1821566, AA235536, AW302988, A1344933, A1344928, AW161579, AW268220, A1610756, A1537677, AA225339, AL036361, A1251221, AW103371, A1498579, A1683340, A1610645, AL041772, AW150578, AL038445, A1860537, AL036736, A1554245, AL119791, AL036403, A1815855, AA572758, A1627988, A1336592, AL039086, A1340603, A1866002, AL079963, A1950664, A1349004, AW074869, A1633419, A1312428, A1859464, A1521012, A1251205, A1308032, A1344785, A1783504, A1284517, A1434281, AW081255, A1922901, A1888944, A1308035, AW023590, A1345347, AW129106, AL119748, AL038605, AW117882, AA427700, AL036274, AL040241, A1349933, A1800453, A1800433, AW059837, AW238730, A1433976, A1636719, AW169653, AW268251, AL042628, A1923768, AL121365, A1491852, A1572418, A1252023, AL119863, A1923989, AL042551, A1318280, AA508692, A1828731, A1564719, AW190042, A1281772, A1889376, A1681985, A1524671, A1345608, AW268768, AW051258, AW117746, A1921248, A1611738, A1590120, A1829327, A1619502, A1677796, A1306613, A1632408, A1802542, AL043981, A1497733, AA658033, A1499285, AW088134, A1886753, A1174394, A1933589, AW026882, A1539153, A1269696, AL045266, A1620284, A1340582, AW002342, A1468872, AA640779, A1868831, A1539028, AW020693, A1334450, AA613907, A1335209, A1698401, A1445165, A1670009, A1862144, A1433157, A1702073, AL036802, A1873644, AW068845, A1648684,

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HTLID06	1789	974047	1 - 648	15 - 662		AW238325, AA513916, AW169687, AI344844, AA371311, AI357551, D53046, AI880168, AW270284, AA54293, AA526514, AA371410, AI884861, D55004, D51877, AA317144, AI298977, D54301, D51997, D55588, AA384911, D51927, D56450, AI885465, R81453, AA365548, AW438916, AA364488, F13749, AI345654, AL135643, AI751162, AW162288, AI696793, AI565581, AA714140, R66997, AW128881, AI590404, AA586433, AW102955, AI914558, AA304790, H38817, AA295893, AA295899, AL040462, T06292, H41462, AA493829, AI214510, R48980, AW327597, AI359368, AI869786, AA572967, AW090629, AW327555, AL137946, AL137954, AW175641, AA583978, H21488, AI907629, AA373861, AW151727, AA658235, AA247731, N43757, AI630283, AI557323, AA435854, AA745560, AI761471, AA745431, AI053672, AA450199, AI801600, AA665293, AI345522, AA655002, R63239, AI921649, AI334443, AI859742, AW081359, AI376100, AI345459, AI336660, AA192740, AA178953, AI340453, AL043756, AW074059, AI064952, AI356904, AI922654, AI564284, Z96530, Z98884, AC004814, AC000114, AL135960, AI131016, AC007450, AC004382, AC007878, AC005034, AC006398, AE000658, AL031643, AL008627, AC006210, AC005370, AL031430, AC005386, AL021808, AC006965, AC006952, AC005822, AC004671, AC008134, AC004593, Z99570, Z84487, AC007970, AL034370, AC004074, AC000027, AC006548, AC004659, D87014, AC004552, AC003101, AC006213, AF011889, AC004616, AL132777, AC012331, AC006030, AL078593, AL008708, AJ011930, AL133353, AL079305, AP000959, AL078476, AC004222, AC006544, and AL049829.
HTLHV59	1790	965808	1 - 530	15 - 544		AA036821, AA877774, AA845452, AA902976, AW027037, AW245073, AI857490, AA948226, AA977183, AI819768, AW085596, AA363071, AA528041, AI804187, AW376089, AI763409, AI524117, AA622713, AW090272, AA973857, AI361156, AA515276, AI686841, AA971889, AI953946, AA595152, AI209096, AI474502, AA918802, AA581475, AI888756, AI129507, AA371872, AW304826, AA632326, AI274834, AI799750, AI206384, AI290279, AI590567, AI340981, AI683971, AI802753, AA352552, AI739258, AA524697, AA417825, AI147766, AA018444, R49435, AW167804, AI281446, AW008926, AI570321, AI143414, AA648251, AA768690, AI468510, T91019, and T34395.
HTLHU81	1791	870150	1 - 863	15 - 877		AA488434, N76166, AA085536, AW390492, AA488573, AA375937, N39974, AA401426,

					AA307647, W05791, N64758, A1148945, C17327, C16676, C17892, A1200786, A1148951, T11417, D80258, C14227, D59503, D81111, D58246, A1535686, C06015, D80014, D80064, D80247, AA809122, C14389, D58101, D80195, AA514184, D80043, D59467, D80391, D59787, D80164, D59502, D58283, D51423, D80022, D81026, C14407, D80196, A1557774, C03092, D80168, D80227, C14014, AA305578, D57483, D59275, D80038, D80251, D80188, D50979, D80157, C15076, D80253, D80269, D80439, F13647, D80302, A1557751, D80166, D51103, D80193, D59619, D80210, D80240, D80045, D59859, C14331, AA305409, D80133, D51799, D50995, D80366, D81030, D60214, D80024, D59627, D59889, D80522, D80212, D80219, AW178893, D59610, D80268, AA400102, D51060, D51022, D80248, AA514188, H67866, D59927, H67854, AA514186, D51759, D80378, C14344, T03116, D59317, C14298, D45260, D80241, AW177440, D59653, D59551, D51221, AW360834, C14973, A1525242, A1525227, D59474, C14429, A1525917, AW360817, C14957, D60010, D59695, A1525923, D51213, A1525920, AW377671, AW375405, D45273, D52291, AW360811, C05695, C75259, T03048, Z21582, AW178907, D59373, AW178908, D51079, A1525235, AW352117, Z33452, C14046, C16955, A1525925, D80949, A1525237, A1525215, AW178906, AW360844, AA285331, A1535959, T03269, AW179328, T48593, AW375406, AW378534, AW179332, AW360841, AW377672, AW179023, AW178905, AW366296, AW177731, AW378528, AW178762, AW179019, AW378533, AW378532, A1525912, AW377676, AW352120, AW378539, AW178914, D80228, AW378542, AW367950, AW360855, AW176467, C05763, T02974, AW178909, AW179020, AW177505, AW352171, AW352170, AW178774, AW177733, AW179024, C13958, AW179018, T02868, AW178781, D51053, D51250, AW378543, AW378525, AW352163, C04682, AW177456, AW178911, AW378540, AW177734, A1525222, AW178775, AW179004, AW179329, AW178980, D31458, AW177728, AW178986, A1525228, AW178754, AW369651, Z30160, AW352158, C14077, N66429, H67858, A1910186, A1525928, AW177508, AR018138, AB002449, A82595, AR060385, AB028859, A1321110, A84916, I14842, A62300, A62298, AR008278, AF058696, AR054175, I50126, I50132, I50128, I50133, AR008277, AR008281, AR016808, AR062872, X64588, AR016514, X67155, Y17187, A70867, AR060138, A45456, Y17188, A94995, D26022, A26615, AR052274, A43192, Y12724, A63261, A43190, AR038669, A25909, I79511, AF123263, A64136, A68321, AR066488, Y09669, AR066487, A67220, D89785, A78862, D34614, A30438, AR008443, X68127, I82448, AR016691, AR016690, U46128, AR032065, D50010, D88547, X72378, A63887, AR008408, Z82022, and AR060133.
HTLHU63	1792	870147	1 - 515	15 - 529	R51662, H17203, R13772, R17328, and AF176701.
HTLHS69	1793	870152	1 - 659	15 - 673	AW166505, A1085633, A1830616, A1948664, A1817701, AW1833365, AW082276, A1471025, AA843215, W31421, AW439937, AA843291, A1476729, AA781027, and W04559.
HTLHS05	1794	933720	1 - 712	15 - 726	A1348086, A1928156, A1074858, AW136076, AW243178, A1262696, AA627913, A1810972,

HTLHK57	1795	894863	1 - 1127	15 - 1141	AA595104, AI858055, AW043820, AI582191, AW001777, AI804955, AI798900, AI242330, AI887909, AW001248, AI813670, AW028151, AI336325, AW243042, AI299745, AI805058, AI923922, AI949719, AI741492, AI304384, M62028, AI276119, AI269740, AI684429, AI183994, AI401041, AI580934, AI097473, AA321296, AA480684, AI200633, AI719036, N42455, AA480650, W68465, AI348656, AA365138, AA335996, AW263563, T48387, AI648474, N66329, AA527274, AA863058, AA642939, AI277482, AI971175, AA884197, AI347141, AI863828, AA367149, AI474817, W68253, W25028, AI262960, AI054319, AI700621, H27099, AW205513, AA987972, AI015046, Z39325, W46985, R60687, T66319, F04561, AI656572, AI026748, F09789, F01927, F04682, AI521950, AI498629, H12192, AI214318, AI580497, H11935, AI136297, T15701, AI161214, AI890045, AI948515, AI866509, AI423812, T07980, and AB021226.
HTLHJ51	1796	865399	1 - 1017	15 - 1031	AA504779, AA491394, AA699349, AA004906, AA778225, AA005001, and AA806914, AA18490, AA418620, AI922829, AI264627, AW002386, AI080674, R61294, AI424861, AI610381, AI263843, AA004548, AW075751, AW080659, AI275462, AA570113, AW271292, W60463, AA453156, AA599740, H09296, H23133, AI473729, AA454079, AA054336, T35266, T35000, AI554231, AW078913, AA502766, AW151599, Z45311, Z38523, N84063, T66912, T31030, R44925, AA363400, R49157, AI521799, AI348847, AI344931, AI038456, AI628833, AW196097, AI345114, AI307494, AI345677, AI340627, AI349622, AI310606, AI345370, AI307446, AI828705, AI312271, AI824648, AI349814, AW081242, AI561087, AI862144, AI312261, AI345224, AI340644, AI311892, AI345026, AI952217, AI582871, AW082033, AW268261, AI553669, AW074869, AI491904, AI241678, AI307210, AI336513, AI336662, AI307569, AI345253, AI344935, AI348895, AI345736, AI313320, AI343091, AI310575, AI336495, AI310920, AI313352, AI307503, AI307736, AI335235, AW029349, AI336585, AI349266, AI334452, AI349787, AI340533, AI344938, AI036215, AI312146, AI590423, AI309431, AI312339, AI340537, AI345258, AI348854, AW148590, AI345471, AI307459, AI334895, AI636595, AI307507, AI348879, AI349245, AI311604, AI349805, AI343131, AI310930, AI349269, AI312333, AW168503, AI310945, AI312431, AI439089, AI038775, AW071380, AI573085, AW020381, AI335363, AI742068, AI311159, AI620093, AI348897, AI345397, AW054972, AI334930, AI307520, AI887775, AI340664, AI307542, AW132104, AA848053, AI349637, AI866465, AI334902, N75771, AW150804, AI336488, AI336565, AI311440, AI345737, AI345396, AI874109, AI922756, AI860694, AI349971, AW268253, AI047422, AI348969, N71180, AI567971, AI366959, AI358042, AI343140, AI366992, AW059828, AI349276, AI539690, AI345315, AA468418, AW274192, AI349645, AI345735, AI349246, AI242736, AI307708, AI865116, AI335476, F31233, F36033, AI345745, AI340659, AW071377, AI050666, AI345005, AI633061, AA427700, AI309443, AI343030, AI619754, AI690930, AW058233, AW021373, AI040694, AI271234, AI623736, AI349186, AI349279,

AI310592, AI312325, AW071395, AI345739, AI345674, AI312143, AI340511, AI334920, AI446405, AI345014, AI345251, AI923357, AI310927, AI307578, AI436429, AI345608, AI349955, AI307456, AW075093, AI312432, AI635690, AI811840, AI581048, AF104032, AI035067, A18777, S77771, X98834, E12580, A08910, A08907, A08909, M19658, AR068466, A08908, I09360, A08912, AR038969, AI133016, A08911, L13297, AF085809, AI137547, X63574, S76508, I89931, A08913, AR000496, U39656, AR053103, I89934, I89944, X69026, I49625, AI133606, AR034830, I96214, AI110225, A21101, AR038854, AP000130, AP000208, AI050024, AI050108, AI117394, AI137648, AI133098, AC002471, AC005374, AF177767, E12579, AJ242859, AF159615, A12297, AF118090, AF143957, AF185614, AI080057, AJ006417, I77092, AC009501, E01573, E02319, E02152, E15582, Y13653, AI049465, AI136884, AF031903, AF141315, E05822, M30514, AI133557, AI137471, Y09972, U62966, AI133112, A08916, AB022159, AC006313, I48978, AL080086, AR054987, AF118064, AF013249, AI122111, I36502, AI049460, AL080127, U87620, AF090896, AI137527, AF182215, U51587, A17115, A18079, AC002382, E08516, U67813, AI050143, AI137526, AI133054, AI049300, AF118070, E03671, AF132676, AI137523, AF061836, AF125949, U68387, AI137656, AJ012582, AL096751, AI137555, AI133072, E01963, AF061573, X83508, U88966, A57389, U36585, AI133093, U92068, U02475, AI137640, X62580, U91329, I18355, U57715, AF106827, AB025103, E01812, I17767, AL080158, I34392, Y10080, S68736, AI110222, X62773, X96540, I89947, AL080118, A70386, AF022813, AI137461, M96857, AR060156, Z37987, AL050116, S69407, Y08616, AF180525, AB030279, AF019298, Z82206, AC006197, AC006112, AC007869, AF172930, AF100781, AF076464, A20553, AF090923, X99257, X70685, AI117583, AF017790, AI133075, X99717, AL096720, AF114168, D16301, I08319, AL049276, I29004, X66417, I41145, AL080060, AI137429, AI122049, AF175903, AI137557, Y11587, U67958, AI133080, A76335, AF210052, X89102, AI137554, X84990, I61429, AI117649, A91160, E07108, AI137712, AI117443, AI110224, AF139986, AI137659, A91162, AF081197, AF081195, AI110218, AF126372, L19437, AI133085, U00763, X57961, X72387, AF106945, S61953, D89079, AF114818, AF036941, X55446, AI117585, X92070, AF017152, AI137281, E08631, AF205861, AI122045, AI133077, AI050146, U49434, AI133014, A27171, AF146568, AI137705, AL050393, AF079765, AF098162, I68732, X59414, A90832, AI117629, U77594, AI137300, AI110159, M84133, AF111112, AB019565, A92311, AF012536, AI133104, AI137556, Y16258, and AF114170.					
HTLHB93	1797	945862	1 - 361	15 - 375	AI828062, AI028564, AW173227, AW102657, and AL035460.
HTLHA63	1798	870172	1 - 554	15 - 568	AI218545.
HTLGS10	1799	963458	1 - 470	15 - 484	AI560769, AI857497, AW151454, AW298056, AW007781, AW166326, and AW339468.
HTLGR32	1800	928245	1 - 943	15 - 957	AI126041, AA812952, AA770544, N26185, AI222967, AA813689, AA815395, AW119183, and AA912724.

HTLGP84	1801	782194	1 - 534	15 - 548	AA709009, AI570570, AA708887, AA062549, AI871015, AA757855, R41916, H80820, AA719341, AA701030, H30641, AA063144, AA757876, AA063046, R87769, H79988, AI003643, AW138067, R12796, and AA758374.
HTLGK08	1802	958304	1 - 463	15 - 477	AA813640, AI766152, and AW403165.
HTLGC43	1803	870228	1 - 484	15 - 498	AI653373, AI917476, AI650958, AI684722, AI632004, AI962304, AI341785, AW195932, AI653363, AI672453, AA778499, AA613494, AW197798, AI968944, AW001758, AA813413, and AA279933.
HTLEQ92	1804	932882	1 - 296	15 - 310	AI962454, AI432386, AI087321, T08978, T77035, R12108, AI093960, R51395, AW196322, and AL117444.
HTLEP21	1805	671151	1 - 402	15 - 416	AA737807, AW296355, AI694694, AI950417, AA448944, AI341643, AW083848, AA316241, AW076055, AI341859, AI950236, AW452665, AI796355, AI338467, AI367080, AF081280, AF079325, and U67172.
HTLEN77	1806	772363	1 - 410	15 - 424	T89583.
HTLEM92	1807	573400	1 - 419	15 - 433	AC005695, AR049867, and U75586.
HTLEL16	1808	384492	1 - 425	15 - 439	R21318.
HTLEG67	1809	751842	1 - 305	15 - 319	AI1149770, AI809937, AA644408, AI808767, AI913293, R06443, and R06497.
HTLDZ81	1810	778180	1 - 351	15 - 365	
HTLDW27	1811	961353	1 - 587	15 - 601	AI479021, AW339781, AW276999, AI369304, AW392460, AI391729, AW392463, AW392466, AW392459, AW392461, AW392468, AW392462, AW372446, AI903603, AB028990, AF014461, and AF032667.
HTLDO01	1812	913669	1 - 703	15 - 717	AI198827, AA397596, AA435832, AC002056, and AC000036.
HTLDG43	1813	715439	1 - 123	15 - 137	
HTLDB18	1814	868533	1 - 436	15 - 450	R18251, and C06467.
HTLCZ79	1815	57853	1 - 273	15 - 287	
HTLCX66	1816	578921	1 - 318	15 - 332	
HTLCO02	1817	921045	1 - 429	15 - 443	AI360679, and AI217856.
HTLCG65	1818	413333	1 - 129	15 - 143	AA420979, and AC006060.
HTLCG59	1819	530039	1 - 205	15 - 219	AB007918, and AF202893.
HTLCA03	1820	870290	1 - 236	15 - 250	
HTLBH67	1821	751985	1 - 432	15 - 446	W19592, and AC005368.
HTLBC07	1822	954111	1 - 662	15 - 676	AA626715, AA403001, and AW003923.
HTLBB72	1823	766270	1 - 711	15 - 725	AW401867, H88137, W19173, AW390017, AI088172, AI970225, AW134697, AW390006, AI971802, AA991241, AA906307, AI808864, AA781530, AI918830, AA742991, AA936350, AI478204, AI523622, AA808091, and AA923464.
HTLAI30	1824	690936	1 - 562	15 - 576	R40037, R60927, AW005925, Z41798, and F01644.

HTLAF33	1825	870300	1 - 432	15 - 446	T27009, Y18503, and Y18504.
HTLAC61	1826	683247	1 - 153	15 - 167	AA323644, T94592, AA298192, N55287, AW162762, AA525407, AA167549, AA459879, N99245, AA522864, AA579082, F00937, W69639, AA132445, F04838, AL133906, AL133902, AA745302, AA297698, AI253376, AA457230, AL046416, N22837, AA568390, N35492, AI207476, AA657910, AI354233, AA523833, AA584756, T73021, AA155817, AA365056, AA363890, AL047480, H87756, AA831997, AA368329, R99076, AI636734, AA338216, AA847427, AW028179, AA357979, AI653783, AW057873, AA809179, AL138091, N34258, AW245354, AI073735, AA847508, AA553830, W52705, AA653291, AA629852, AA632765, F34605, R93224, AI471467, AA668711, AA302763, AA467740, AA654293, AI471455, AA468135, AI734119, AA352521, AI732720, H43183, AI475294, AI687343, AA368201, AW392414, AA133013, AI733856, AC005914, AP000501, AC002111, AC004862, AL132987, AC005547, Z74617, AP000359, Z92845, AL031985, AC005332, AC011456, AC006992, AC007225, AC005412, AL009174, AC005399, AC002375, AC002299, AC000070, AC006197, U52111, AL050337, AC009946, AL022721, AB023049, U24498, AC005300, AL031283, U95740, I39891, AL022163, AL035541, Z86090, AC004531, Z99716, AC004673, AL035534, AC006512, AL035089, U47924, AL078581, AP000141, AL035413, AP000088, AL035405, AC002470, D87675, AC002565, AP000344, AL034420, Z98044, AF111168, AC005821, AL031293, AC005235, AC005670, AC002425, AC006130, AC005796, AC009516, AC005058, AP000556, AP000557, AL049692, AL033504, AC005379, AL133382, AC002077, AL031295, AC004587, AP000495, AC002483, AC005702, AC006101, AC007388, AL133371, AC007151, AC005057, AC000035, AC007731, AL022313, Z98941, X64467, Z83838, AC004148, AL022238, AL049869, AL035072, AC005998, AL022326, AL121748, AC002302, AL035587, AP000065, AL049814, AC002472, AC003043, AC006023, AL136295, AD000092, D63861, AL030996, AL033381, AC006116, AC004098, AC005014, AP000343, AL022322, AP000114, AP000046, AC004242, Z97053, AC005899, AL049569, AC004893, AC006146, AL022316, AC003086, AL109801, AC004816, AL049553, AC004383, AC004813, U72790, AC000025, AC005089, AL050319, AL031662, AC006543, AL031587, AC007387, AC006544, AC000085, AC002326, AC005527, AC004079, AC005500, AL109963, AP000493, AC004882, AC007216, AC004858, AC003687, AL122023, AC004491, AF109907, AC004883, AL137549, AF020662, AC004790, AC005265, AL049653, Z98750, AL023575, AC007868, AC006141, AC004466, Z81365, AC008115, AC006210, AC005669, AL049570, AP000513, AP000353, AC009263, AP000550, AC002314, AL133163, AC006080, AC004985, AC004841, AC006486, AR036572, U91328, AL021878, AC002511, AC005272, AL034344, AC005826, AC006379, AC005800, AC008018, AL031007, AP000352, AC004849, AC006449, AL080243, Z93244, U80017, AC006538, AC006011, AC004106, AC005529, AC005160, AC007565, AC003972, AC004792,
HTLAC39	1827	575343	1 - 214	15 - 228	

HTLAB55	1828	732480	1 - 451	15 - 465	AC007546, AC005182, AC007746, AL031984, AC005005, AC009247, AF196779, AC008078, AC006312, AC009731, U82828, Z83836, AC005324, AL031729, Z99129, AC003108, Z93017, AF047825, U07000, AC005066, and AC005839.
HTLAB29	1829	879168	1 - 432	15 - 446	T65363, and FI1993.
HTFBE02	1830	920507	1 - 571	15 - 585	AA023022, H51019, AI309636, AI569285, AI431902, R90861, AI740858, and R23430.
					R92414, AI197116, F00607, AI923217, AI814569, AI804663, AI762903, AI804682, AI143304, AI082030, AI139520, AI911904, AW274978, AW450838, AI216343, AI183410, AA680119, W93273, R92413, W93272, AI918971, T51116, AI823928, C15320, R42713, T51024, T96094, AI422647, AI216344, T96093, AI936703, AI869077, F00114, AI741425, C00216, Z66165, and Z56024.
HTEQS95	1831	972746	1 - 654	15 - 668	
HTEQS90	1832	973426	1 - 667	15 - 681	
HTEQP03	1833	870516	1 - 584	15 - 598	AI652668, AW196588, AI611041, and AI696211.
HTEQN83	1834	908528	1 - 331	15 - 345	AA442506, AA436703, AA080897, AA219287, AA214213, AA332559, AA356572, AW197626, W86428, AA083980, AW239273, AL042822, AW137277, AW197400, AW197285, AA772083, AW206752, AA854258, AI934409, AL096747, AB021642, AB021644, and AB033024.
HTEQB08	1835	958291	1 - 711	15 - 725	AI144505, T83402, AW439340, and T81586.
HTEPY28	1836	870559	1 - 682	15 - 696	AA412612, AA412499, AA719038, and AI149873.
HTEPV63	1837	870549	1 - 917	15 - 931	AI217359, AA229749, AI990822, T80962, AI393339, AA935552, AC005844, and AC006205.
HTEPE35	1838	948475	1 - 825	15 - 839	AI935040, AA861064, AA933697, AA707583, AA872105, AA398866, AA609626, AA620685, AA435866, AA812556, AA781805, AA993718, AF012362, AI217888, and AA824315.
HTEQY82	1839	948845	1 - 489	15 - 503	AA724785, AW341727, AI990635, AW138616, and AI010949.
HTEOO83	1840	836721	1 - 720	15 - 734	AA885943, AI807908, AI214900, AI810745, AA725810, F31353, and H91431.
HTEOE28	1841	870581	1 - 846	15 - 860	AI222323, AW274395, AW104230, and AA917623.
HTENY44	1842	870588	1 - 320	15 - 334	AA860344, AW449340, AI188119, AW241563, AI218844, AA725683, AA860397, H48932, AA398488, AA416572, AI654971, AA719259, AI797656, AI337070, AA416676, H52862, AA402604, and AL137366.
HTENV06	1843	933294	1 - 479	15 - 493	N41901.
HTENS74	1844	773925	1 - 544	15 - 558	N41653, AI879320, AI879319, AW249274, AI928959, N33827, AA701980, AA156930, AA777363, AL047958, AL048281, H95107, W68434, AI015217, AA364327, W68552, AA909383, W32502, AI188322, AA906240, AI741757, AA021053, AA329553, R16958, AW401707, AA281392, H00750, AA032085, W25157, N88679, AA534002, AI142442, AA552483, T85967, T75519, W88713, H94009, AI985732, AW248852, AI362972, AI240796, AI929211, AI129518, W84587, W84606, AI708380, AA156806, AA954310, AI369295, AA745783, AW291743, AI096816, W88714, AA301938, AI167203, AA356672, F23466, AA666297, W60290, AA922513, W37200, W02166, W60381, AA090596, AI040943,

HTENR26	1845	870595	1 - 292	15 - 306	AA535548, AA628365, AI937756, AA576306, AW206638, AA927434, AI565666, AW292178, AI266717, AA181912, AI078402, AA429252, N24950, AA430649, AI189422, AI348358, AI690429, R55029, AL047959, AI811153, AA430402, AI741768, AA774634, AI567256, AI400297, AI004611, AA488479, N93305, AW406490, AA582428, AI554548, AL048282, AW193651, T79324, H54744, AA321085, AI866522, AA037421, W79170, AI239605, AA352112, AI439069, W74366, AA096370, F37003, F33844, AA649533, AI300497, AA995088, F13662, AA632491, AA886406, N83253, AW272778, AA721011, AA744603, and AC004148.
HTENR26	1845	870595	1 - 292	15 - 306	AW374010, AI360575, AI018337, AW188121, and AC005879.
HTENQ92	1846	790908	1 - 639	15 - 653	AW188190, AI026684, AA861425, AI656213, AI148424, AI597882, AA978263, AI806072, AI560944, AA609392, AW103266, W19795, AW341673, AA135775, AA131502, AI274049, AI559891, AA131402, AI797927, and AA135731.
HTENP08	1847	958382	1 - 433	15 - 447	AW293376, AW002918, AI206147, AW235254, and AI968897.
HTENL95	1848	795314	1 - 652	15 - 666	R95033, H98000, H15506, H54108, Z43087, and F07410.
HTENL73	1849	974363	1 - 705	15 - 719	AW368483, AC004671, AB015617, and AB029004.
HTENA08	1850	958380	1 - 193	15 - 207	AW118931, and AI205921.
HTEMY05	1851	880592	1 - 349	15 - 363	AA074939, X85715, and AA193675.
HTEMV66	1852	813038	1 - 456	15 - 470	AA430250.
HTEMU66	1853	944419	1 - 1078	15 - 1092	AL039924, AL045794, AW013814, AL036630, T02921, AL044412, T24119, AL044364, T24112, AW450335, AL039476, D51250, D80253, D80043, AL040992, AL039109, AL038531, AL037726, AL039629, AL039625, AL039648, AL038837, AL039074, AL039678, AL039108, AL039538, AL039564, AL039156, AL039659, AL039566, AL039509, AL039521, H00069, AL039128, AL044407, AL036973, AL045337, AL037051, AL045353, AL039386, AL039423, AL045341, AL042909, AL039410, D59787, AL039150, AL044530, AL038821, AL038025, D80219, AL036725, AL043422, D59275, AL043445, AL039459, AI535983, D80227, AL043586, AL043423, D80240, AL043441, D80210, D51423, T23947, AL036650, D80134, AL036196, D59619, D80391, AL037639, D80193, AW451070, AL037615, D80196, AL036767, C14227, AI039085, AI535783, D80949, AL036117, D80366, D59927, AL037526, AI042334, AW452756, D80168, R47228, AL036238, AL036679, AL037601, T11051, D81026, AI039504, C14014, D50995, C75259, AL039842, AL036964, D80045, AL036733, AL036158, AL037027, AL036924, AL037054, D59889, AI036765, T23659, AI557751, AL038851, T23658, AL037177, AL036998, D80022, AL037047, AL044413, AW293068, AI037643, AL036227, AL036418, AL036133, D80038, T11417, AL037082, AL036163, D58283, D80195, AL036207, AL037124, D81030, D80188, AL037021, AL036191, AL036167, AI036132, AL037049, AI037679, AL036190, AL037600, D51799, AL036139, D80378, F13647, D80522, T03269, AL036152, T23656, C14429, T48598, D50979, D80212, AL036900, Z21582, AL037178, AA514190.

AL048425, AA285331, AW451416, D59502, AL043613, D58253, AL039555, AL043585, D80166, D59859, AL037085, D80268, D80269, Z25782, AL037569, D80024, D52291, C14331, AL036174, AL036808, AL036953, D57483, Z99396, D59610, AW450376, AL044178, D80241, AL036150, D81111, A1910186, D80164, D59627, C14389, H00072, C15076, D59467, D51060, AA305409, AL036268, AW178893, D51213, D51079, C14298, AL038043, N47620, D80251, AW177440, D51022, C14407, AL044447, AW179328, D80014, AW178775, AL037077, AW378532, AA305578, D80064, AW352158, D80248, D59695, A1905856, AW369651, D51097, AL043840, AL037002, AW178762, AA514188, AW177501, AW177511, AA514186, D80133, AW360834, AL039417, AW360811, C05695, Z25783, A1557774, AW135155, D80258, T02974, AW352117, AW176467, AW375405, AW378540, AW377671, AA809122, AW366296, A25909, A85396, A86792, A44171, A85477, X68127, AR062871, A84772, A84776, A84773, A84775, A84774, AR037157, AR017907, AR062872, AR062873, AR067731, AR067732, A58522, A91750, A20702, A43189, A43188, A20700, AR036905, A95051, AR038762, A95117, A38214, A98767, AR031374, I56772, I95540, AR018924, A49700, A63067, A51047, A63064, AR018923, A48774, A63072, A95052, A48775, AR068507, A18053, AR068506, A93963, A93964, A23334, A75888, I70384, AR043602, AR015960, AR043603, AR043601, A58521, AR000007, AR015961, A18050, A60111, A23633, A10361, A23998, AR007512, AR020969, I60241, I60242, I63120, AR054109, I03343, AR031375, AR022240, A58524, A58523, A81878, A24783, A24782, E12615, AR035193, A92133, E14304, A27396, AR027100, I28266, A49045, E16678, A82653, E16636, I06859, A93016, I25027, AR000006, I26929, E13740, I44515, I26928, I26930, I26927, A58525, I49890, I44516, A58526, A91753, AJ244003, AR025207, I18371, E06034, AF156296, A13038, A29289, AR029417, AF156294, AR067733, AR029418, AR067734, A64081, AR028669, AR028668, AR028667, AR028670, AR017908, A68112, A68104, A98467, I62368, AR031488, I13521, I52048, I44531, A84746, A17115, AR028672, A18079, AR038066, I50882, I15353, I66495, I66498, I66497, I66496, I66486, I66487, A71440, A71435, A67220, I13349, A07699, E08322, I74623, A60109, AJ244004, U87250, I00081, A70040, AR028564, A83643, A98420, A98423, A98432, A98436, A98417, A98427, A83151, I01968, A13388, E00974, A02228, E00954, E00952, E00953, E00955, I08049, I43960, AR021440, E03165, E02221, E13364, A10360, E02679, E02104, E02098, A92666, E02001, E01718, E02003, E02102, E03550, A28163, E02100, E01997, A58998, E02291, E02292, E02293, E01999, E02396, E02327, E01563, E02431, E01693, E01696, A92668, AR005163, AR005154, AR005157, AR005160, I09250, AR005153, A92667, E01024, AR050583, AR050584, E02430, E01148, E12527, E01503, AR005165, E12523, E02432, A49701, A62009, E01216, I77211, A95096, I70974, I31847, I31848, AR060673, AR060676, A95106, A95105, A80476, A91965, E01324, I08638, A80474, A94048, A94061, A80477, AR035224, A80475, A94046, A94054, I63560, AR031529, A49428, I63561, I63563, and E16036.					
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HTEMS01	1854	915308	1 - 576	15 - 590	AW182380, AI016150, AA436052, AI016144, AA459652, AI110776, AC007227, AC004536, and AL049761.
HTEMO58	1855	964769	1 - 475	15 - 489	AI026760, H54090, W90174, AI016127, and U22296.
HTEMN80	1856	775543	1 - 301	15 - 315	T80539, and AI719083.
HTEMM91	1857	938396	1 - 378	15 - 392	AI655972, AI809237, AI872211, AI377032, AI381901, AA523409, AI150552, AI248517, AW328508, AA523391, AI241274, AA609120, W92335, AW194863, AA580479, AI912966, AW243314, Z25384, AI217725, AA531424, AI142666, AW137703, W56565, W56787, AI678791, F17380, R95131, AW057531, and AI825787.
HTEMI51	1858	870613	1 - 583	15 - 597	AI149866, and AA918162.
HTEMB57	1859	849214	1 - 456	15 - 470	AA398093.
HTELY90	1860	787549	1 - 356	15 - 370	AI022425, and T86122.
HTELV29	1861	806421	1 - 627	15 - 641	AA083981, AL043302, AL050276, AF194030, and AF185576.
HTELP07	1862	952274	1 - 550	15 - 564	AI005651, AA502325, and AI005304.
HTELM71	1863	954982	1 - 509	15 - 523	AA843728, AW303661, and AA813137.
HTELA02	1864	918699	1 - 602	15 - 616	AI651239, AW268856, AI024356, AI016924, AI016923, AI698585, AA609414, AA620951, AW072208, AI696034, and AI340253.
HTEKU62	1865	754010	1 - 713	15 - 727	R13043, AA402245, W03238, and AA293855.
HTEKI62	1866	812862	1 - 472	15 - 486	AA741257, W23913, AA769417, AI923864, AA099994, AA113016, AI633572, AI129921, AI740509, AI087861, AI198728, AA451698, AA811514, AW328432, AI345992, AW135872, AI865582, AA769447, AA716235, AA946657, AI818126, AA742292, AW025858, AI092084, AI864067, AI992065, AW027054, AI129952, AW105702, AA527064, AW166911, AI969997, AW263370, T12481, AI571406, AW243885, AA192190, AW134596, AI143876, AI143870, AW136628, AW009874, AI475650, AA063520, F21628, AA781441, F37014, AW074003, AI928446, AA736768, N91862, AA774271, AI611242, AW363815, F33207, AW328431, AI470616, H39778, W76151, W72588, AW444846, AW368798, AI479056, AI861919, AI223368, AI760686, AA973718, AA991724, AA804626, AW449436, AI217528, AI246328, AI391628, AA977169, AI222649, AI453599, AI825699, AI968087, AA910938, AW294100, N74597, AI587076, AI738417, AI818572, AI347378, and C00207.
HTEKH17	1867	942526	1 - 643	15 - 657	
HTEKD77	1868	772397	1 - 414	15 - 428	N47372, AA029276, AW173125, T51928, AW197647, AA436376, N56847, AI142573, AA885319, W26719, AI961121, R52187, AI032543, AW009278, T51718, AA902217, W37315, AI370687, AA495856, AI073556, AL041264, AF147339, and AP000533.
HTEJV94	1869	793039	1 - 381	15 - 395	AI628611, AA416585, AA420969, AW271467, AI831883, AI928360, AA421125, AW001638, AA397955, AI656005, AW016672, AW003460, AL110224, and AC003669.
HTEJO46	1870	717850	1 - 388	15 - 402	R72953.
HTEJN12	1871	653252	1 - 443	15 - 457	AA223373, AL096763, and Y18004.

HTEJL30	1872	696784	1 - 386	15 - 400	R92318, R97141, D61526, W58524, R13204, AA333107, AW163212, R55599, H23092, D52777, AI929587, C05240, R19781, D61319, AA150352, Z46053, AA355121, AA296708, AA323111, D53669, R26633, H08329, AA317832, AA322876, W01316, AA973604, AA374431, R49663, AA296782, H23093, H85812, AA149563, AA318184, AI368381, AW088920, AI253781, R40292, AI928933, AI857794, AI452755, AI160425, AA975568, AA961868, AI718865, AA776210, AA025635, AA337795, AI191849, W73632, N79435, AA679726, AA865487, W78161, AW339133, AI582690, W58412, AI744177, AA902205, H97698, AI338657, AI338667, AW452422, AI187166, AA330474, AA333363, AA976009, AA126618, AJ239435, AI572582, AA085720, R55362, AA360533, AW166355, AI879369, AW163740, AI752339, AI302066, AI954021, AA355733, T57729, T60002, AA332269, AW160676, AW403792, AA111927, D61306, N31004, AA064830, W79204, D53612, AA961222, AA845309, AA186387, W07796, W73680, N58648, AA642523, AA151815, AI805801, T30103, D54012, T36033, AA393418, AF092135, and AL109701.
HTEJC70	1873	490772	1 - 587	15 - 601	R94482, and AI004651.
HTEJB07	1874	953801	1 - 451	15 - 465	AA993947, AW134645, AA884829, AI004532, AI150514, and AI239661.
HTEIS34	1875	887112	1 - 371	15 - 385	AI002739.
HTEIS25	1876	870660	1 - 390	15 - 404	AI208897, AI187424, AA682756, and AI187850.
HTEIN26	1877	684711	1 - 403	15 - 417	R72964, W76526, R64535, and U82396.
HTEIL36	1878	708304	1 - 425	15 - 439	AA417003, AA835058, AI424995, AI220270, AA694436, AW182313, R20520, AI382131, AI004786, AA418740, AA418795, AI190974, Z39070, AA742556, and AI809322.
HTEIJ58	1879	491030	1 - 528	15 - 542	N71729, N71226, AP000041, AP000109, and AP000285.
HTEID15	1880	395868	1 - 247	15 - 261	
HTEIB38	1881	839966	1 - 318	15 - 332	AA724539, and AA960890.
HTEIB37	1882	870671	1 - 336	15 - 350	
HTEIB03	1883	921926	1 - 223	15 - 237	
HTEIA57	1884	734983	1 - 489	15 - 503	N38963, and R92356.
HTEHX57	1885	734976	1 - 442	15 - 456	AW451115, AI863336, AW104507, AI692981, AI652017, AI827145, AI017283, AI955549, N33485, R76560, AW409808, AI207003, AI202422, and AI927281.
HTEHV11	1886	967439	1 - 561	15 - 575	AA916546, AI204535, and AL021331.
HTEHS17	1887	664436	1 - 391	15 - 405	AA424196, AA846387, AI797455, AA778547, AW340809, AI217364, AI188208, AI150580, AI123441, AI027637, AA770175, AI150190, AF012356, AA909271, AF012355, and AA442327.
HTEHU11	1888	964956	1 - 242	15 - 256	C04728, AA381098, N45678, AA480568, W69682, AA397755, AA476511, AA476550, AI860245, AW024421, AW382036, AW382039, AA838817, AW382042, AW382037, AW381999, AW382041, AW381961, AW382000, AW381997, AW934010, AI363359, W69923, AW190584, N36268, W44317, AA181315, AI864889, AA130883, AI745226, AI934734.

HTEGW02	1889	920628	1 - 1006	15 - 1020	AA187057, W38774, AW382054, N26942, A1469219, A1380284, A1380273, W45689, A1057575, A1725447, A1360479, N48961, and A1057565.
					A1288698, A1914273, A1203577, A1696478, AA913934, AA812691, A1573252, A1936975, A1015501, A1280024, AW054753, AA975903, A1371833, A1160502, AA844728, AA687959, AA393300, F34643, AA813782, T53463, A1091343, AA435624, AA595143, T53462, A1364294, and A1217827.
HTEGU55	1890	931017	1 - 376	15 - 390	R61288, R05576, AA778664, AA280073, AB014581, and Z98752.
HTEGS24	1891	932987	1 - 598	15 - 612	AA256743, A1374955, A1123527, AA251700, AA455406, AA429834, AA618437, Z28611, A1433315, AA331686, A1498096, AW203957, A1377211, AA770064, AA808245, AA828466, AA098810, AA331825, AA814045, AA101241, A1078061, AA625885, H53435, AA357747, and D42054.
					R13795, and R14717.
HTEGJ74	1892	765901	1 - 474	15 - 488	N32789, AA992305, A1829630, A1453589, A1037906, AA490671, N47354, AF106857, and AF026169.
HTEGJ56	1893	732630	1 - 607	15 - 621	W87922, and AA694342.
HTEGJ38	1894	709420	1 - 356	15 - 370	A1125270, A1025275, A1017509, AA724721, AA970833, AA904629, and AC002128.
HTEGH60	1895	545137	1 - 207	15 - 221	N51343, A1341075, A1967945, AL035252, Z79996, AL031775, AL021978, AC002384, and AC002455.
HTEGC30	1896	690998	1 - 463	15 - 477	N41791, A1734225, W21309, AF026169, and AF106857.
HTEFX90	1897	887616	1 - 568	15 - 582	AA011636, AW136535, AA641738, A1242200, AA972854, A1357112, A1252660, A1919234, A1732405, and AW379801.
HTEFU18	1898	666920	1 - 623	15 - 637	AA188885, AA189066, AA834951, AA971947, AW389450, AA856992, and AA189065.
					N78395, and H45135.
HTEFO46	1899	719280	1 - 537	15 - 551	AL044999.
HTEFO28	1900	685383	1 - 470	15 - 484	AC004259, and AC004600.
HTEEU78	1901	530196	1 - 327	15 - 341	
HTEEU35	1902	707717	1 - 102	15 - 116	
HTEEU27	1903	575476	1 - 275	15 - 289	
HTEEU18	1904	530203	1 - 348	15 - 362	AA442512, AA002017, N68854, AF122013, AF064102, AF000367, and AF064103.
HTEEU17	1905	530200	1 - 371	15 - 385	
HTEET22	1906	675071	1 - 395	15 - 409	N55308, A1201311, and AA709195.
HTEEF25	1907	677513	1 - 329	15 - 343	AA461517, AL040379, A1825108, AL040378, AC007981, AC011718, AC008103, AC012330, AC007708, AC007324, AC009288, AC008079, AP000550, AC007325, AP000552, AC008018, and AC008132.
HTEEB82	1908	780161	1 - 326	15 - 340	H53320, R97852, A1032585, H53321, R97802, AL033531, and AL034424.
HTEDX39	1909	530201	1 - 246	15 - 260	AC005726.
HTEDX04	1910	927850	1 - 330	15 - 344	AF111169.

HTEDX03	1911	925353	1 - 190	15 - 204	AW002847, AC005300, and AC006946.
HTEDW96	1912	881958	1 - 539	15 - 553	AA101046, AA860334, AI240068, AI381744, AA064659, M79124, AB006626, AF132607, and A86973.
HTEDW59	1913	530448	1 - 201	15 - 215	AI139615, and AL117627.
HTEDV86	1914	785818	1 - 497	15 - 511	W87362.
HTEDU53	1915	727362	1 - 443	15 - 457	N75217, AI827641, and AI313263.
HTEDS40	1916	934047	1 - 496	15 - 510	N64316, and AA418089.
HTEDS06	1917	960645	1 - 839	15 - 853	AA557354, AA004230, AA702179, AI671185, AI924143, AI609113, AI056239, AI638795, AI337375, AA634413, AW250803, AA417152, AI135398, AA478510, AA195614, AA190630, AI814763, AA827285, AI091408, AI638180, AI080126, AA632206, AI379107, AI288872, AI263619, AA626405, AI679151, AI754325, AI769841, AI559213, AI679722, AA417030, AA552345, W93249, AA007263, AI969543, AA766364, AA534494, AI038181, AA960978, AA449336, AA573241, AW043937, AA725439, AI291838, N73539, AA189108, AI699813, N73585, AW104716, AW166044, DI9671, AW192890, AA454518, AA621586, H73339, N54283, AA910989, H14801, H05808, N56013, H75580, AI038699, AA248270, AA149737, H70079, AA808510, AI806228, AI806407, AI628327, AI079833, W93248, AA478509, and AF044588.
HTEDO75	1918	767024	1 - 184	15 - 198	
HTEDK72	1919	766343	1 - 339	15 - 353	AI693509, and H95965.
HTEDJ92	1920	522827	1 - 294	15 - 308	
HTEDJ63	1921	508086	1 - 310	15 - 324	Z98257.
HTEDI09	1922	522969	1 - 397	15 - 411	AI797509.
HTEDI01	1923	961028	1 - 230	15 - 244	AC006960, AC005015, AL035249, and AL049569.
HTEDH90	1924	909165	1 - 403	15 - 417	R79137, AA314329, AA323430, U69560, AC007731, and AC005500.
HTEDH76	1925	522940	1 - 208	15 - 222	AC004945.
HTEDH42	1926	615250	1 - 459	15 - 473	C03196, C03292, F00515, AA361228, AW003009, AA626353, AW403239, W67213, AA314421, W05346, W63719, AI346486, W24987, DI2319, DI1537, AA423922, N45183, AR053393, and AF092130.
HTEDH30	1927	522936	1 - 237	15 - 251	AL049697.
HTEDH17	1928	522938	1 - 371	15 - 385	
HTEDH06	1929	869427	1 - 392	15 - 406	AC006251.
HTEDG75	1930	890715	1 - 358	15 - 372	
HTEDG26	1931	519947	1 - 384	15 - 398	AW246994, AA421090, AA421091, AA397662, AA375279, R83399, AI638717, AA306667, AA747622, and AC000378.
HTEDF96	1932	614726	1 - 323	15 - 337	AA242852, AA252186, AI129391, AA743400, AI934605, AA531278, AA705950, AA418351,

HTEDF70	1933	522977	1 - 294	15 - 308	AA834128, and AC006942.
HTEDF60	1934	742368	1 - 356	15 - 370	AC004983.
HTEDF22	1935	908406	1 - 291	15 - 305	AI656191, Z21349, and Z21348.
HTECE66	1936	522997	1 - 403	15 - 417	AC002418, Z83843, and AC004386.
HTECE62	1937	523002	1 - 407	15 - 421	
HTECE61	1938	789732	1 - 543	15 - 557	AW241925, and AC005232.
					N80927, AA400153, AI027600, W58447, AA813400, AA746206, AI139801, AA828177, AW375643, AI279610, AI359755, AA444123, AA443944, AA569017, AA451805, AI089230, AI632987, AI338403, AI262825, AA767495, AI005034, AA453635, AA454013, AI560993, AW250814, T30813, AW149100, AW327945, AW207031, AA629893, AI342923, AA922333, F37015, AI745194, AA676942, AI086189, AI276499, AW058509, AI682025, AW004973, AW009042, AI367703, AI445623, AI241535, AA441932, N73089, AW295548, AI188497, F04870, F10561, W58482, Z41848, T35208, AA548624, AI094343, AA923598, AW440500, W76342, AW080667, AI720047, T17396, R37034, F22096, R39180, AA833987, AA197182, AA426126, AW363378, AI797280, AA196359, T19458, AI743371, AA090309, R34367, AA446271, T61317, AW407104, N71508, AA075086, AA383602, C21530, AI371957, AA192312, N22129, N91820, AA374751, AA213591, AA813578, H43284, H97310, C00318, T10425, T98391, AA832076, AI049609, AA740854, AA349688, AA369853, and AL035405.
HTECE51	1939	870723	1 - 301	15 - 315	
HTECE39	1940	650885	1 - 389	15 - 403	
HTECE31	1941	508104	1 - 284	15 - 298	
HTECE08	1942	960428	1 - 421	15 - 435	
HTECD94	1943	527210	1 - 318	15 - 332	AI025190, AL137266, AC005071, AC005488, AC004878, and AC006014.
HTECD88	1944	527214	1 - 342	15 - 356	AA804334, and AW007980.
HTECD70	1945	527203	1 - 324	15 - 338	
HTECD65	1946	533795	1 - 328	15 - 342	
HTECD56	1947	527209	1 - 178	15 - 192	
HTECD15	1948	523029	1 - 402	15 - 416	
HTECC71	1949	508142	1 - 370	15 - 384	
HTECC45	1950	508124	1 - 317	15 - 331	AA406427, H66890, H64867, H66639, H69191, AA693972, AA410436, AA931060, N38830, H48140, AI247909, AA251684, N23377, N76083, AA887276, T61107, AW328038, AI681235, AW328039, AA608986, H72100, N71448, AA188574, C02442, H70867, R94076, AA394213, AA487534, T68446, AC005185, AL121877, AC006039, AL121578, AC006458, AC005544, AC005014, Z84481, AP000261, AP000100, AP000035, AC004696, AC002094, AC008040, AC005774, AC006157, AC005284, AL049834, AL080250, AC006150, AF048727, AL022393, AC004448, AC007001, AF129077, AF165147, AC008009, AC004202, AP000518, AC002383,

						AB023054, AP000692, AC003119, U91325, AC006355, AI031542, AC005853, Z69722, AI031315, AI035461, AF011889, Z83826, AC004975, AC008085, AI022318, AC004664, AC005862, Z76735, AC004746, AC007286, AP001101, U80460, U91324, AI133162, AP000075, Z97180, AC002531, AC002511, AC003034, AI135922, and U95738.
HTECC26	1951	508144	1 - 403	15 - 417		AA393147, and AA398551.
HTECC09	1952	678659	1 - 353	15 - 367		AA306529, AA306591, AA826008, AI089960, AA887528, AI333816, AA513786, AA524465, AI125407, AA541685, AA446158, AA315157, AI185832, AA603451, AI660483, AI871796, AI138696, AI563976, AI141745, AI479416, AI304867, AA938482, AI342761, AA281870, AA102814, AA586819, AA526476, AW157657, AI878833, C14084, AI815670, AI879393, C15292, AA931242, AA125855, W19566, AI081138, AA248470, AA070996, D59838, AW138570, AI660905, AA442677, D60576, AA776763, AI038860, AA527168, AI879973, H72163, AI096871, AA887522, AA535032, N29179, AA437187, C15125, AW163651, AA100697, AA070617, AA126067, AA682431, W21262, R58065, AI217985, W95562, H64391, H91983, AA352582, N53018, AI125841, AI356704, AA927737, AI336049, AA889266, AW272440, AA502617, AA431548, AI184304, AA833674, F35247, AA369535, W39436, AA281586, AA575968, W95435, AI056604, AI350076, C14543, AA878900, AA947125, W15344, AI537988, C15570, AI085201, AA732059, AI184964, AI569557, AI301035, AA429855, AI889555, AA513631, AI000301, AA592946, AA317358, AI797215, AA722721, AA758447, AA721039, AI339315, AA947500, AI149920, W37085, AA682224, AA962818, AA52223, C15228, AI073583, AI051738, AA737832, AA303269, AA548883, AA991817, AI869608, AA923511, AW297214, W07566, AI222563, AA991676, AI301328, AI376085, AI080573, AA364733, AI031902, W04779, AA878574, AA600861, AA779628, AA091291, AA322774, D81321, AI039006, D60527, AA782434, AI202852, H89937, AW192683, N80835, AA356010, AA301770, AA304243, AA129809, H91874, AI198092, D60707, T93983, N20273, AI271711, W24482, D60706, and AA369534.
HTECC08	1953	960439	1 - 341	15 - 355		
HTECA44	1954	508135	1 - 427	15 - 441		AW086066.
HTECA39	1955	508132	1 - 408	15 - 422		
HTEBP54	1956	728811	1 - 736	15 - 750		R62332, H17378, and R25901.
HTEBO43	1957	715704	1 - 304	15 - 318		AI928432, AI291335, AI803224, AI298002, AI985197, AI924618, AA489696, AA489695, AI806154, AW138014, AI241232, AW291969, N36798, AA436451, AA765512, AA743624, AA020798, AA848065, AA436498, AI221817, AI768422, and AA015614.
HTEBM87	1958	503275	1 - 278	15 - 292		AA383834, AA383833, AW117332, and AW268492.
HTEBL53	1959	578544	1 - 355	15 - 369		AA383796.
HTEBJ02	1960	921321	1 - 408	15 - 422		H73473, and AA383702.
HTEBH09	1961	870732	1 - 560	15 - 574		AI204211, AW274576, AI285857, AA383617, AI394396, AA442838, AI218526, AI214386,

HTEAX06	1962	960792	1 - 413	15 - 427	AA781925, AA725598, AA758847, AI671527, and AI125254. AW300891, AW182267, AI002121, AI393590, AW268430, AA812869, AI363725, AI937132, AI370331, AA431750, AA383228, C20655, and AI537879.
HTEAV22	1963	679394	1 - 449	15 - 463	H16258, AI362696, AA159083, AI337351, AI049674, H05276, AI963664, AA612853, AA421018, R50945, AA398617, AI276451, AA868365, and AA383003.
HTEAU39	1964	503295	1 - 428	15 - 442	R45446, AA994896, AI285099, AI419926, AI219508, AI650680, R41613, AA383142, AI264406, AI942371, and AC005752.
HTEAT17	1965	667184	1 - 298	15 - 312	AA416657, AA394107, AA629341, AA382909, AI075928, AI150321, AI204602, AW022487, AA397912, AA862555, AI066604, and AA442269.
HTEAS02	1966	921323	1 - 527	15 - 541	AI203924, AA383061, AI215017, and AA861908.
HTEAR93	1967	503298	1 - 361	15 - 375	AA383056, and AA383057.
HTEAQ55	1968	732562	1 - 1106	15 - 1120	AI979276, AW117497, AW269774, AA701653, W46209, AA778787, AW269767, AI218590, N20493, W28100, AA039403, AA781351, AI025502, AI696076, W26315, AI281715, AA088596, N25525, AI220590, AW136955, AA758981, AA406069, AA972182, AI634149, AA628118, AI819755, AI215556, AA039283, N33500, AI218587, W46210, AA382922, AI476428, AI766748, AA724549, AA723963, R84858, R85787, AW087598, AW275213, C20812, and AC004805.
HTEAJ96	1969	503533	1 - 421	15 - 435	AA382756, and AA382755.
HTEAH75	1970	503546	1 - 324	15 - 338	AA382618, and AA382617.
HTEAG47	1971	503623	1 - 411	15 - 425	AA707221, H91075, AA677780, H90565, AA382495, AA382494, and AI825267.
HTEAG08	1972	960469	1 - 322	15 - 336	AW298466, AA382538, AA504454, and AA382537.
HTEAB50	1973	724751	1 - 310	15 - 324	AA459803, AA382330, AW084476, AW118229, AA770485, AI393130, and AA894604.
HTEAA04	1974	925522	1 - 533	15 - 547	AA431127, AA432144, and AA382138.
HSWBY36	1975	708291	1 - 413	15 - 427	AA993042, and N22565.
HSWBT69	1976	867537	1 - 366	15 - 380	W25339, AA046193, AA449279, and U36384.
HSWBE29	1977	412991	1 - 394	15 - 408	AI034154, AI075224, AI273184, AA912285, AI950513, AI885608, AI35673, AI887898, AI080389, AW243126, AA912258, AI656815, AI869093, AA743734, and N62780.
HSWAS65	1978	953051	1 - 391	15 - 405	AI149166, AW134820, W74519, AI126334, AI458127, AI702779, AW241716, W74520, AI313414, AA325604, AI085318, AA028905, AI809343, AA927327, AA621660, H18963, W79859, and U87223.
HSWAS18	1979	666302	1 - 481	15 - 495	AI341837, H29745, AI744756, R86286, H27353, and C02105.
HSWAR63	1980	471236	1 - 343	15 - 357	AI368388, AI375597, AI333175, AI096336, AI143097, AI371774, AI863007, AI143646, AI401020, AI264622, AI955198, AI830291, AI871932, AI089379, AI361917, AI669393, AI083964, AI130018, AI284009, AI763092, AI313424, AI860304, AI761302, AI802694, AI689622, AI807536, AI889890, AI283822, AI984147, AI436614, AI831700, AI401294,

					AW166231, AI373088, AW440862, AI283398, AI628021, AI076054, AI160352, AI356262, AW303797, AW027683, AI076901, AI750565, AW138762, AW205241, AW131274, AW182727, AI633329, AW027104, AI826608, AI131379, AI082361, AW051864, AW007685, AW148788, AW015247, AI309293, AI761146, AW152138, AI917165, AI094866, AI991300, AW055285, AW189932, AW167782, AI19815, AI140238, AI559315, AW205065, AW026436, AI625376, AI493229, AI435865, AI141874, AI142533, AI283228, AI524717, AI985076, AW139124, AW205019, AW089459, AI147674, AI142533, AI352600, AI365199, AI359053, AW134846, AI418837, AI452497, AI084650, AA761057, AI352600, AI365199, AI359053, AW134846, AI281009, AI189810, AI927109, AI475646, AW008134, AI347476, AI127254, AI798042, AI245694, AI084053, AI472105, AI858658, AI346716, AI805265, AI056708, AI168084, AW168327, AI335542, AW016943, AI763091, AW080734, AI344496, AW001416, AW134801, AW138795, AW139783, AW134778, AI083683, AI436570, AI356539, AI913071, AW291502, AW205777, AI364682, AW135748, AI805245, AW118495, AI378537, AI751342, AI017678, AA731725, AA743409, AI284044, AI367653, AI244522, AW129260, AI274414, AI336615, AI521300, AW206154, AI817686, AA768889, AA687148, AW204642, AW067873, AA748715, AW206063, AI344202, AW204658, AW134471, AW134992, AI498998, AW272203, AI751403, AI184103, AI365388, AI868143, AW029417, AI096546, AI193953, AI274606, AW068441, AW149182, AI475878, AI884460, AI056487, AI242557, AW075326, AW058138, AI956107, AA934582, AW087680, AW277100, AI937167, AW086079, AI992000, AI040279, AI440481, AI290523, AW103911, AI266204, AI383396, AI636832, AI872349, AI092810, AI382023, AI471042, AI745657, AW082335, AW207085, AW079700, AI991258, AI934795, AW150946, AI359264, AI797905, AI244599, AI205545, AI985061, AI952709, AI250781, AW170789, AI916414, AW150829, AI290207, AI208838, AI824627, AW137667, AI916148, AW169534, AI439477, AI126922, AW138184, AW139537, AI369691, AI018609, AW028207, AI858490, AI282372, AW014680, AI500554, AA775869, AW014451, AI123239, AI553795, AI554710, AI350901, AI241918, AI865208, AI274094, AI366682, AI379191, AI144370, AI417103, AI990960, AI871260, AI264233, AA533302, AA654830, AI284364, AW205575, AW207168, AW089185, AW137590, AI873120, M11167, M11120, M27830, U13369, X59734, AJ270046, M29181, X02995, X59733, X82564, X00525, V01270, AF061798, AF061799, U17964, U17965, U17962, U17963, J04633, AF074093, S48220, U34339, U34337, U34341, U34342, U34340, U34336, AF061800, U34338, L15286, AF132045, U67616, AF086136, D86039, AF061797, AR016103, A85605, A85520, A86292, A65652, E08821, A71562, AF059516, X59474, S78388, A22946, and L20636.
HSWAQ31	1981	697856	1 - 405	15 - 419	AI621111.
HPWTA06	1982	936026	1 - 611	15 - 625	AA197067.
HPWSA52	1983	727294	1 - 336	15 - 350	H87580, and AL035699.

HPWDC45	1984	839559	1 - 521	15 - 535	R05355.
HPWDF03	1985	924978	1 - 701	15 - 715	W87370, AI168586, AA678331, T96677, W87371, and T96792.
HPWDE86	1986	785710	1 - 362	15 - 376	R34114, and R62645.
HPWCJ90	1987	789170	1 - 385	15 - 399	AA036882, AW073808, AW006251, AI992106, AI089385, AI095532, AI143143, AI979301, AI750308, AW001022, AI147683, AA046259, AI598152, AI201784, AW235719, AI696115, and AA011669.
HPWCG85	1988	638155	1 - 1025	15 - 1039	AW172969, AA601278, AA469230, AI376239, AI609972, AA847704, AI431434, AI249365, AA601680, AA829065, AI053934, AL042539, AA857812, AI281818, AW089016, AI620992, AA169245, AW089322, AI282629, AA480486, AA704101, AI446623, AA609834, AI859438, AI340151, AA130647, AA622479, AI912401, W60522, AA904211, AA491767, AI783911, AA563770, AA487142, AA992562, AI961983, AI417469, AW264901, AA828047, AA828867, AI133083, AA911590, AA484892, AI224583, AA573062, AW408767, AI279417, AI061313, AA704393, AL041970, AW407632, AL046519, AI445224, AA197019, T47138, AA578832, AI445934, AI053597, AI054418, AW303872, AI417464, AA587826, AA487645, AI500552, H38769, AA176605, AI355559, AA701105, AI636734, AI277373, AI613465, AA362349, AI989408, AA598605, AI355246, AI733856, W63553, AI598060, AI049931, AI243793, AW341955, AA985201, AA468956, AI762528, AA632765, AI189682, AA683279, F23338, AW105729, AI598056, AW157616, R91827, AA515631, AI362552, H95769, AI206841, AW410409, H71678, AC005740, U80017, U95090, AC006312, AC005696, AC005412, AC002565, AP000044, AP000692, AC005529, AP000113, AL035587, AL079304, AC004819, AF111169, AP000045, AL121603, AL035249, AL031311, AL031670, AL139054, AC005081, AL021546, AC005288, AC005071, AC005730, AL021878, AC004492, AP000555, AC004983, AP000112, AL035086, AC005952, AC006211, AP000330, AL021391, AL031657, AC005620, AP000557, AB023049, AC002094, AC004491, AC002115, AC005971, AC007792, AC006111, AC007057, AL024498, AC004765, AC002316, AC007707, AF196969, AC005225, AC005940, AC007226, AC000353, AL022238, AF053356, AC002350, AD000092, AC005837, AC005839, AB003151, AC004796, AL096701, AC004596, AC005037, AF165926, AC020663, AP000501, AC002312, AP000959, AP000140, AC005231, AC005067, AC004991, AR036572, U91328, AL078581, AP000031, AC005031, U78027, Z98946, AF001550, AL022318, AF045555, AC005776, AC005480, AL080243, AC005874, AF134471, AF001549, AF134726, AC006241, AL050307, AC005409, Z84469, AP000212, AP000134, AC005914, AC004953, AC004910, AP000350, AC006088, AL035457, AL049759, AC007363, AL109627, D84394, AF111168, AC004531, AL031846, AC007216, AL034420, AC005803, AC004662, AC005049, AC007686, AC006049, AC005180, AC003007, AL133445, AL034429, AC006130, AL031281, U47924, AC005625, AC007298, AL031431, AP000553, AL035659, AC007666, AC006965, AL022326, Z93930, AL049795, AC006011, AC005695, AC002126, AC002302, AC005911, AC005324,

					AC004019, AF207550, AL035422, AJ003147, AC004185, AL049709, AC005666, Z83840, AC006285, AL031255, AF064861, AC006543, Z82244, AP000228, Z83845, AC006120, AC004854, AC005200, L44140, AC002477, U52112, AP000088, AL079295, AD000812, AL109801, AC006449, AL031284, AC005520, AL022320, AC004167, AC004253, AC005057, AC003029, U95739, AL021154, AL049692, U85195, AC005829, X87344, AP000248, AL050341, AL132712, AC009516, AF088219, AC005102, AC006360, AC005082, AC007283, AC007308, AL008718, AC000052, AC004832, Z83826, U91326, AL096791, AC006480, AL020997, AC004929, AC005089, AF030453, AL034548, Z95114, AP000558, Z81369, AC002425, AL034423, AF196779, AC007450, AC004448, AF196971, AC002404, AC006581, AC004000, AL031584, AC006544, AC005800, AE000658, AC005484, AC002470, Z93244, AL117337, AC005527, AC005358, AL109798, AC002091, Z86090, AL022302, U91318, U96629, AL022721, AC005280, AC004158, AP000695, Z82203, Z85987, AC007421, AC006254, M89651, AC006538, AC003963, AC007277, AC006255, AC005632, AC007227, AC005722, AC006501, AC002551, and AP000513.
HPWBF35	1989	707514	1 - 219	15 - 233	AA136312.
HPWBE47	1990	720563	1 - 532	15 - 546	T61306.
HPWAT23	1991	676323	1 - 277	15 - 291	W31570, and AF136745.
HPWAJ85	1992	535157	1 - 326	15 - 340	AI681684, AI458401, AI936264, AW055212, AI200740, AI635739, AI973110, AW044010, R60842, AI690626, AA281860, AI823929, AI142509, AA781250, and Z95115.
HPWAJ39	1993	575271	1 - 202	15 - 216	N76233, and R18040.
HPWAI05	1994	932627	1 - 551	15 - 565	AI671077, AA506744, AI859744, AF047825, AL049757, AC005529, AL022721, AC004491, AC005823, AC005081, AC005527, AL132712, AL022316, AF001549, AC002312, AC002477, AC005015, U95742, AP000952, AC005488, AL035587, AP000501, AL021155, AC003982, AC006511, AF111168, AF109907, AC007216, AC000353, AC000003, AC005484, AC005037, AC008372, AC005837, Z93023, AL035450, AF088219, AC004675, AC004253, AL049761, AC006241, AC005911, AL139054, AL031848, AC009516, AC007227, AC005740, AC005694, Z99127, AC005666, Z95114, AC007993, AC005736, AC002470, AC002549, AC006430, AC005899, Z85987, AC002400, AC005225, U47924, AC002310, AC007686, AL080243, Z93017, AC005940, AC005696, AJ246003, AC004125, AC002072, AF111169, AC006277, AC004685, AC006254, AC006347, AC006312, AC005924, L78810, AC007225, AC003108, AP000555, Z84466, AP000553, AC002365, U52112, AC004841, AC005412, AC005565, Z84469, AC005291, AL109963, AL034420, AL021546, AP000694, AL121603, and AC006121.
HPWAG31	1996	693618	1 - 271	15 - 285	N59310, and W26272.
HPVAH71	1997	829301	1 - 378	15 - 392	AW084140, AI660275, AI159785, AA931541, R46761, AI017335, H69563, AI253649,
HPVAH41	1998	848632	1 - 658	15 - 672	

HPVAC74	1999	773298	1 - 623	15 - 637	AL046863, A1718728, A1860915, AA421105, AA780157, AA622029, AA564314, T85269, A1187002, H93474, AA862619, AA860857, N51712, A1092970, A1093731, A1288177, AA725376, AA397987, A1632608, N95238, A1383237, AW273559, AW014246, AW025440, N75603, A1089430, H84661, A1074224, AA877282, T96893, AA430388, AA994095, AA577687, A1962794, AW071881, A1147145, AA627632, AA757265, A1348280, AA292692, N62956, A1022266, A1039833, A1332399, N63622, H92137, AW452472, AA452012, W94925, W95270, N80289, T67556, A1800953, A1524405, AA937741, AA946602, AL046862, A1202094, A1471911, AW362569, and AF161509.
HPVAB16	2000	526124	1 - 199	15 - 213	A1803004, H82351, A1912547, A1684625, A1093039, AA043382, A1700890, A1016549, AA043383, AA789239, AA868305, T03714, AW449266, and A1990568.
HPVAB01	2001	961017	1 - 340	15 - 354	AW183886, AW295375, H73304, and AA455018.
HPRTJ65	2002	753933	1 - 616	15 - 630	A1123463, A1025472, A1827469, AA916957, H86257, A1457871, AA748446, AW295278, AA058998, AA888811, AW293429, AA047229, AA012881, A1738469, Z65045, and Z65044.
HPRTI54	2003	728812	1 - 542	15 - 556	AA193128, and W24151.
HPRTI16	2004	667652	1 - 540	15 - 554	H80993, T58115, and T58181.
HPRCV66	2005	320393	1 - 543	15 - 557	AA454985, AA232735, AA454986, W25444, AW303344, and A1368936.
HPRCT83	2006	780264	1 - 470	15 - 484	AW450541, Z43026, T96106, and AC007377.
HPRCN03	2007	925420	1 - 513	15 - 527	AA032184, AA152299, and AC007182.
HPRCM12	2008	973740	1 - 582	15 - 596	A1074020, A1187913, and AC004056.
HPRCL72	2009	766311	1 - 234	15 - 248	Z81007.
HPRCI73	2010	764710	1 - 325	15 - 339	N53915.
HPRCG46	2011	719340	1 - 450	15 - 464	AA594588, and A1821697.
HPRCD11	2012	967762	1 - 377	15 - 391	H17732, AA195383, A1268825, and AA609857.
HPRCC22	2013	526623	1 - 258	15 - 272	H63477, AW386067, and AC003006.
					AL135490, AA460352, A1538075, AA635150, AA661590, A1926876, A1921744, AA557945, A1040051, A1144125, AA600202, A1049999, AA578245, AA112646, AA720732, A1344906, A1318548, AA640305, A1620666, AW341903, AW270258, AA469230, AA595661, A135357, F00564, AA846923, AA482682, AA555232, A1910608, AA847095, AA767660, AL044966, A1749823, AA483606, AA570740, AA831714, A1568376, AA568204, AA430137, AW104161, A1753904, AA857296, Z36862, AW419227, AA045734, AA584241, A1434653, AA846944, AW021674, AA501410, AA086042, R95840, AW270385, AA505012, A1572680, A1079154, N72170, AA229113, A1279693, AW021116, AA493546, A1523356, A1821608, A1803824, A19191418, AW192419, AA828758, AL048275, N66775, AA367986, AW020094, A1164946, AA828840, AA994578, A1357762, AA808875, T57562, T41235, N23913, AW404543, AA862243, A1433952, AA872299, AA502532, AA804726, AA345665, A1573003, AA493245, AA568433, AA653139, A1926104, AA523718, AA584148, AW021399, A1601376, A1003391,

AW057760, R99617, AA713946, AA714956, AI249683, AL120708, AW165963, AA826134,
 AA828771, AA58402, AA58716, AA582554, AW72815, AI590404, AA631915, AA018207,
 AA487053, AI754257, AA302661, AI984168, AI791426, H6812, AI732473, AA525112,
 AA659360, AA749235, AA706291, AA182731, AL079553, AI356440, AA828802, AA828781,
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 AC005488, U91326, AF198095, AC004531, AC003663, AF111169, AC001228, AL121754,
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 Z97054, AF109907, AC016025, AL109801, U62293, Z93023, AC000085, Z98950, AL121653,
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 AC009516, AC004000, AC005089, AL109952, AC006285, AP000255, AC005231, AC004796,
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 AL031666, AC005005, AC002404, AC007363, AC005304, AC004408, AC002472, AL031588,
 Z98750, AL133353, AP000213, AC005015, AP000345, AC005529, AC004832, AC007686,
 AF165926, AP000135, AL034402, AC005274, AC004493, AL031230, Z97353, M87914,
 AL022323, AC007066, AL021939, AL117330, AC007298, AC006958, AC004020, AL035420,
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 AC004381, AL049766, AP000501, AL049843, AL022331, AC002544, AC005570, AL078581,
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 AC005736, AC005911, AC005624, AC004019, AC005844, AC004673, Z95327, AC007664,
 AC008055, AC007917, AF187320, AL034419, AC007041, AC004962, AL022237, Z98949,
 AL022313, Z99716, AB022785, Z82190, AC004605, U43572, AC004458, Z82189, AB003151,
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 AL133448, AF207550, AC005531, AL136168, AC003109, AC004821, AC000079, AC004230,
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 AL109657, AC004598, AC005412, AC004801, AF001548, AL049830, AC002492, AC002558,
 AL078602, AC002996, AC004841, AC006211, AL050338, AC004685, AL034421, AF196779,
 AF196969, AC002565, AL049760, AL008582, AL080243, AC005618, AC006277, AC000134,
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 AC004859, AL136295, AL133371, Z93017, AC007021, AP000356, Z93241, AL096677, and
 Z98051.

HPRA02	2014	917289	1 - 376	15 - 390	
				AA564925, AI904944, AA666295, AW151247, AA972523, AA102737, H62923, H86579, AI624551, T05617, AA984920, AL044271, R77715, T94072, AA468974, T05684, AA230025, AA468371, AA228979, AA229823, AA484892, AA228368, AA224889, AA468505, AA228269, AA772704, AL137946, AA402113, AW243945, AA593828, AA467943, AI671077, AL041815, AA614254, AA224815, AA720582, M85967, AA664248, AI801563, AW419126, AA181479, AA88638, AL038533, H93152, AA550959, N27874, H81012, AA502110, AA714110, AA558404, AI278211, AI560073, W24312, AA612578, AA298647, AA890060, AA377325, AA745628, AI819391, T71936, H54252, R99076, AL118912, AW105463, AA581525, AA780933, AI369076, AA322484, AL047467, AA747977, AA550989, AI668605, AI567391, AI306717, AA548221, AA302978, H94979, AW242279, AI249688, T07878, AA329535, AA773463, AA631729, AL041681, AA482792, AL041682, AA630854, AI500315, AF031078, AF030876, AF031076, AC006344, X05151, AC005899, U07563, AL033539, AC001226, AC004983, AC009946, AC003002, AL022336, AP000207, AP000129, AC004112, Z82215, Z73913, AL049712, Z93023, AL035457, U52112, AC005207, AC000090, AC005157, AC005186, AC005089, AC007312, AL133355, AC004961, AC005841, AF196971, Z93017, AL024498, AL035661, AL122020, AC012627, AC006014, AC004593, AC005488, AL031282, AL023575, AC007371, AF111168, AL031003, Z49237, AF124730, AB014077, AC000387, AC004209, AP000514, AC000003, AC004686, AC004241, AC003963, AL035461, AL133247, AC005212, AC005393, AC005484, AC003015, AL031587, X87344, AJ246003, AC004539, AC006034, AL049758, AF064863, AC010200, Z68284, AC005856, AP000289, AP000042, AP000110, AC002073, AL096791, AC004770, AC007436, U91321, AC007934, AL121658, Z83844, AC006387, AL022330, AC004032, AC005751, AC004963, AL136504, Z82976, AF001552, AC007666, AF109907, AL034347, AC007040, AC005372, AC002365, Z68276, AP000261, AP000035, AP000100, AC005911, AC004022, AL022395, AC005343, AC004531, AC005252, AL121782, U73479, AP000096, AC004223, AC005588, Z86090, AC007279, AC006023, AC007565, Z86064, AP000503, AC005067, AP001058, AC005829, AC002369, AC007639, AC004159, AC002538, Z98941, AC010205, AC005409, AC005874, AF134471, AL135744, AC004953, AP000355, AC009542, U35114, Z85986, AL049795, AC005620, AC004865, AL031657, AC005011, AC004673, AC004858, AL023553, AF048729, U62631, AC006080, AF134726, AC005726, AL031295, AC003998, AF205588, AC005280, AP000691, AL049569, AL031186, AD000092, AC004887, AC005045, AC004477, U91319, AL008734, AC006445, Z70280, AC002468, AC006367, AL009031, AC002326, AC005412, AP000223, M57678, U96629, AC003689, AC003043, AC006468, AC010170, AC000115, AL008721, Z97632, AC002040, AL035414, AC005913, AC005919, AL121769, AC004805, AC004815, AC005837, AL139054, AC003101, Z49258, AC005101, AP000303, AP000046, AP000114, AC004585, AC005695, AC004388, AC006515, AF064866, AL031311, AP000502, AC005300,	

HPRBN23	2015	467480	1 - 442	15 - 456	AC002395, AC006965, AC007536, AL031885, AL021917, AC006076, AC005383, AL032821, AC006211, AC005375, AC004035, AC005362, AC007205, AC004663, AC005884, AC004941, AC002402, AC006270, AL133163, AL133500, AC009330, U85195, AC007406, AC005041, AL022163, AC004890, AP000690, AL050341, AC006262, AC004460, AL031666, AP000689, AC004886, AL035413, AP000553, AC009516, and AC004491.
HPRBI87	2016	695116	1 - 229	15 - 243	AA148577, AA371499, AI190166, AW182200, AW450886, and AL080125.
HPRBH80	2017	781636	1 - 395	15 - 409	AA371425, R08248, W78735, AA002229, AI034386, and AC004582.
HPRAV80	2018	781637	1 - 574	15 - 588	AI796794, H16396, AW450892, H06067, AA885838, AA370953, R40187, Z38928, F01486, F02763, and F04922.
HPRAN56	2019	503140	1 - 455	15 - 469	W55957, AI379296, AI191798, AA987330, AI688094, AA001362, AI655136, AI277583, AW235235, AI080751, AI341857, AA936711, AA907791, AA001353, AW002519, R00840, AA370556, AA897172, and R01496.
HPRAN50	2020	724753	1 - 334	15 - 348	AA370553, and AA370552.
HPRAJ75	2021	766496	1 - 351	15 - 365	AA370391.
HPRAG73	2022	764757	1 - 734	15 - 748	W94997, AA370226, and AFI23462.
HPRAG45	2023	484691	1 - 268	15 - 282	AA370201, AL031295, AL096775, AL034548, AL022323, AL049757, AL117258, AL021707, AP000031, AC003982, AC009516, AP000359, Z95115, AC002538, AC005031, AC005519, AP000135, AP000557, Z83844, U80017, AC005406, AC005261, and AC004983.
HPRAF86	2024	784594	1 - 219	15 - 233	AA369988.
HPOAB37	2025	789290	1 - 526	15 - 540	AI670779, AA384366, AA687253, AA505096, AA732524, AI525876, AA461291, N50753, AA461408, AI095123, AI393841, AI141520, and AA522490.
HPMSH94	2026	796839	1 - 599	15 - 613	AA214535.
HPMSB35	2027	707476	1 - 245	15 - 259	W05600, and U47671.
HPMMK05	2028	928283	1 - 824	15 - 838	AI312886, AA709064, R25113, R25114, AI271454, and AW131860.
HPMMB08	2029	957945	1 - 679	15 - 693	N57273, AA975894, AA078184, AW271847, AI720195, C13996, R67746, AI469577, AA322542, AI580260, AI926706, AI338117, W60077, AA865083, AA663975, W01985, AI039539, H72865, AA747234, W04464, F07235, AI253290, AA604201, AW270771, AI277347, AA492527, AI039125, AI266359, T65747, AI581433, D44787, T78912, F02611, H58207, AA577754, AA297195, AA630122, AI884861, AA160427, AA481811, AA721530, AA363003, AI288033, AW243945, R51217, AA721523, AI678581, R56848, AA078137, H01327, AA745351, F10272, AA161198, H67098, R67701, AA745383, H11450, AA484419, AA484370, AA678616, AA664248, AW270429, F35684, T90962, AA668166, AW270351, AA714073, AA491423, T05617, AA018895, AA478518, H01243, AA376358, AA780933, AI366993, AI859906, AI278847, AI915081, I171449, AI869786, AI679221, AA167550, N63848, T30418, AA457408, AW019964, AA309362, AA013366, T07903, AA345594, N77384.

				AA679353, AA302520, AA665908, AA772873, N57674, AA457254, A1927261, AL134418, AL031670, AF044083, AC005972, AC002395, AL136295, AF075066, AC005243, AF001550, AC007684, AL133289, L16854, Z82189, U52683, AC006360, U89336, L35668, Z49236, AF135187, AC007292, Z84489, AC007421, AL021579, AC005377, AC005383, AC007240, Z99572, AC005612, AC005620, AL133246, AC007406, AC007283, AC004476, Z99130, AL009183, AC000015, AL031115, AL008635, AL035587, AC004134, AC006000, AC006014, Z82214, AC005099, AC000378, AL035653, AC004552, AL133396, AL020995, AL049646, AL079304, AC005325, AC004887, AC006079, AC005488, AC005041, AC007207, AC003037, AF003626, AL109662, AC004186, AC002451, AL049766, AC000045, AC004811, AL008725, Z97630, AC002550, Z82244, AC005067, AC005231, AC006597, AL031291, Z98742, AL022326, AC005875, AL049759, AC007130, AL035415, AC007314, AC006316, AC012331, AC003665, AC004448, AL008723, AC005799, AL035091, AC005921, AC005747, AC007327, AL031681, AL021937, AC008126, AC005261, AC009509, AL031733, AC004382, AC005348, AP000517, AB023054, AC006251, U96629, L29766, AC004792, AC002984, AC004791, AC002316, AL033523, AL022166, AL034379, AC007041, Z82182, X54486, X13922, AL139054, AC006064, E12647, Z49155, AC004693, AC005759, AC002309, D87013, L48038, Z82208, AC005778, AP000300, AP000563, AC002390, AC006958, AF042484, AC004814, U07563, AC004938, AC004771, AP000113, AP000045, AP000133, AP000211, AC005800, AL049610, AC004703, AL031622, AC004929, AC007128, AC004991, AC005060, AC006509, AF030453, Z83822, AC002554, AC003106, AL132712, AL021154, AC003663, AL096773, AC006044, AC002476, AC005969, AC006026, AC006011, AC005535, AC007395, AC005088, AC004674, AL096701, AC004491, AL133238, AC005722, AC005042, AL049776, AC005291, AC005516, AL133244, Z95114, AC005015, AC005406, AC000353, AC005914, AC005225, AP000688, AC004650, AC004775, AL035420, AC005014, AC007349, AC007637, AC004623, AC004961, D84394, AC002480, AC004796, AL133445, AC004983, AP000130, AP000208, AC007955, AL049832, AP000247, D87009, AC006501, AC007792, U47924, AF037338, AF091512, AC004453, AC005209, Z98304, AJ003147, AC007011, AC001231, AC005082, AC002375, AL008734, AL021578, U95740, AC006013, AL033527, AC005412, AC005193, AC007198, AL135746, Y17293, Z68756, AC002054, AC002472, AC007664, and AC008018.	
HPMKP06	2030	933895	1 - 328	15 - 342	AA436495, A1801028, and AB002353.
HPMKC05	2031	930874	1 - 501	15 - 515	R97706, and Z73979.
HPMJT12	2032	969483	1 - 663	15 - 677	T84974, T91224, R00550, and R00654.
HPMJN08	2033	958009	1 - 377	15 - 391	R06344, AW452106, AA729350, AL031295, AL122023, Z99128, AC007637, AC007298, AL022166, AC007917, AC004779, AL008635, AC007151, AC018633, AF109907, AL022721, X55448, and L44140.
HPMIK11	2034	965636	1 - 504	15 - 518	H54909.

HPMJK03	2035	867615	1 - 493	15 - 507	AW193499, T41385, AA325521, AA417987, T05187, AW440956, AW439999, AA907133, AI000677, AI537915, AI791144, AA844107, AA287035, AW298615, AW088364, AI537814, AA715387, AA523882, AA687547, AI302974, AA121818, W46473, AI798234, AA906440, AI120129, AW148336, AA484366, AI801031, AA308708, R55092, AI821120, AI688963, AI821864, AA018440, AI660071, AA334287, AA069926, W27874, R96138, AI811076, AA767864, AA227741, AC011594, AC006538, AC002126, Z68871, Z68281, AC004156, AL133500, AL031230, LI3972, AC004812, AL034423, AC002400, M61107, U62317, AC005067, AC003663, AF111170, AF059321, AL049758, AC004104, AF155238, AC005803, AP001065, AC004703, AC002365, AC007279, AC002394, AP000365, AL031686, AP000547, AC002565, AC005049, AC007263, AL022721, AC006966, Z97630, AC006509, AL050318, AC004887, AC003098, Z85997, AC007868, AL031295, AC004253, AC004890, AC004876, AC002558, AC004916, AL009181, AC002116, AC002984, AC002070, AP000555, AC005578, AC004674, AC005323, Z95331, Z93930, Z82206, AC009263, AL022476, AF196970, Z95115, AC006125, AC002551, AF114156, AC006157, AP000104, AC003982, Z98044, AF121781, AL031280, AC004985, AC005015, AP000344, AL049779, AL022336, AC004814, AL031681, AC003013, AC004962, AF061032, AC000085, AC002425, AC005519, AC005880, AC007040, AC002524, AL034400, AC004149, AP000510, AP000345, AC008042, AC005520, AB023048, AC002036, Z73964, AC009533, AL132777, AC004991, AP000270, AJ011932, AC003684, AP000032, Z82195, AC006360, AC005800, AL121852, AC000086, M63543, M63544, AF181897, Z84487, AC005821, AL049569, AC006026, U95740, AC002464, AF050154, AC007229, AF020802, AP000687, AL035414, AC004383, AL117694, AC004990, AC002312, AC003950, AC002985, and AC004084.
HPMJ11	2036	963627	1 - 487	15 - 501	AI244898.
HPMJE06	2037	939682	1 - 575	15 - 589	AI022159, and AI240345.
HPMJA11	2038	965628	1 - 446	15 - 460	H85685, H82116, H85672, and H92336.
HPMGX92	2039	491004	1 - 561	15 - 575	AI733856, AI627614, AA587728, AA573722, AI133083, AI354333, AI270370, AI524193, AA458452, AW194325, AA683069, AA491423, R67701, AI049999, AA614163, AA513851, AC007055, AC005527, Z83844, AC005529, AC007792, AC006026, AC004832, AF196971, AP000355, AF111168, AC007371, AL049757, AC002477, AC005488, AC005531, AC006441, AC005015, AC006139, AC002565, AC005500, AC005837, AP000555, AL022721, AC007731, AC005071, U47924, AL121603, AB026898, AC005902, Z82244, AC000025, AC007386, AL117337, AC005049, AL033527, AC004895, AC005164, AC005011, U78027, AC005291, L77570, AC005696, AC007546, AL109627, AC005180, AF130342, AL133404, AC008044, AC006039, AL121658, AL049776, AC006064, AL079342, AC007541, AL096791, AC004448, Y18000, AL035405, AP000014, AL049839, AL078638, AF029308, AC004890, AC005971, AC004882, AC004991, AC004815, AC007842, AC004525, AL035681, AC005081, AC009247,

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HPMGR15	2040	660374	1 - 429	15 - 443	N95527.
HPMGO88	2041	463906	1 - 460	15 - 474	N66134.
HPMGGM39	2042	705460	1 - 1424	15 - 1438	AW027268, AW299861, AI057303, W01903, N80342, N91193, AA010796, N68397, N64546, AA011135, AW194796, AA133637, N71008, AA393085, AI284257, AA133638, AI017033, HI2527, AA412114, R27162, AA365161, W01706, N58095, and AI288082.
HPMGJ16	2043	662021	1 - 214	15 - 228	AA297666, AI219169, AA228459, AA503119, AA829576, T07039, AI732869, AI821987, AA707849, AW250905, AI799327, AA489571, AA516047, AA626823, AI610376, AA381750, AI500453, AA424438, AI244157, AW179306, AC005015, AC006271, AC007637, AC002310, AC005484, AF207550, Z99943, AP000066, Z93016, AC006120, Z97053, AC007237, AC005666, AC005280, AP000466, AC007308, M89651, U50908, AL133485, Z93017, AC003043, AL035461, AC005088, AL109801, AP000353, AC004477, AC004223, Z75887, AL008718, AC005067, AL022312, AC007938, AL133448, AC006141, AL022163, AL109984, AC002470, AC006511, AC005091, AC005899, Z98749, AC007285, AC003684, AC004962, L81691, AL009183, AL121653, AL049869, Z94056, AC002996, AC012384, AP000030, AC006441, AL109865, AC003007, AC004491, AL031427, AC002365, U85195, Z86090, AC002544, Z93241, AL034429, AE000658, AL031311, AC006480, AL049748, AC007055,

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HPMGD63	2044	694518	1 - 682	15 - 696	N59650, Z40592, F02367, and AA480778.
HPMFx29	2045	690704	1 - 616	15 - 630	W84490, W84350, AL044564, AI972017, AF086479, AF097027, AF097026, and AC002992.
HPMFL73	2046	867670	1 - 717	15 - 731	AA773011, and AF047825.
HPMFC02	2047	920327	1 - 904	15 - 918	AI361020, AI806300, AI339924, AA972324, AI689765, AI141310, AI798724, AI005122, AW015619, AI002107, AA721275, and Z59058.
HPMFB26	2048	867674	1 - 348	15 - 362	AA736385, AA262258, AL022164, AC005520, and AC007559.
HPMEG77	2049	772503	1 - 397	15 - 411	AA178897, AA178882, and AA179898.
HPMDQ89	2050	880787	1 - 444	15 - 458	AI634152, AI624814, AL135959, and AL049631.
HPMDP10	2051	968350	1 - 415	15 - 429	AW002399, AW450136, AI624994, AW082789, AI936619, AI953139, AA923323, AI377859, AI808017, AW452164, and AL109754.
HPMDF06	2052	954567	1 - 114	15 - 128	W28809.
HPMAM93	2053	791407	1 - 361	15 - 375	R42698, AI971147, AW001714, AA985608, AW025311, AI367373, and AA369641.
HPMAL77	2054	772740	1 - 628	15 - 642	AA149508, H66540, H53279, R99964, and AA369352.
HPMAL73	2055	764752	1 - 155	15 - 169	AA369348, AA018792, and AI439103.
HPMAK71	2056	503690	1 - 428	15 - 442	AA369278, AA369277, AA368633, AA297498, R86114, R92608, AC008101, AC016830, AC005736, AC006252, AC002477, AL024507, AC016027, AC006205, AC005303, AL035458, AL031683, AC004966, AC005695, AL031295, AL035682, AC005082, AL008729, U52112, AL109764, AC007350, AR036572, U91328, AF003529, AL049839, AC006213, U95742, AC004477, AC002369, AL035420, AC004916, AC005666, AC007371, AF111168, and AC007216.
HPMAJ83	2057	781518	1 - 396	15 - 410	R10536, and AA369467.
HPMAI80	2058	572808	1 - 331	15 - 345	AA369413.

HPMAII0	2059	968695	1 - 202	15 - 216	AA303040, AA369200, F18842, AA535216, N23913, F17700, AA489939, AA603530, AI281818, AA829044, AI349580, AI682665, AI884383, AA659608, AA633762, AA385798, AI538658, AI047349, AA993818, AI537458, AI251429, AA463590, AW088745, AI439910, AA837035, AI041894, AA633920, AI354564, AA701080, AW068316, AA584125, AI087040, AA376760, AA639946, AA312303, AA372949, AA679794, AA502818, AI054333, AA661499, AI753113, AA302969, AI814739, AA449997, AI079734, AI453714, AA994578, AW023111, AA608751, AW085623, AA947269, AW079664, AI382324, AI537424, AA984187, AW084246, AW402458, AA621838, AW149156, AW302017, AA722039, AA904137, AA613624, AA601356, AA452906, AI933714, AA714322, R92983, F31380, AI119600, AW410354, AA483381, AA362714, AI056177, AI798493, AW188976, AI583321, AI207424, F16133, AW268277, AI383057, AI053911, AI925491, AA338262, T57767, AA779783, AI590593, AA847622, AA484370, AA484419, AI860587, AA811208, AA157458, AA601327, AW196014, AI254779, AA282820, AA083003, AA084609, AW073510, H45698, AI754037, AA579208, AA558404, AI002941, AA078337, AI054352, C14692, AA715173, AA206132, AP000695, AC007999, AC006333, AC005565, AC004659, U91326, AC005666, U63834, AC005821, AC005015, AI031311, AI022323, AI050307, AC002544, AC002477, AP000556, AC005069, AC005399, AC005412, AC003100, AC005803, AC003959, AC005602, AP000114, AI035495, AI135744, AC005011, AC007731, AJ229041, AC005500, AC003665, Z95118, AP000512, AI049636, AC005387, AC000134, AI049757, Z95114, AC005225, AC004821, AC004386, AI034423, AC004883, AI049776, AC008015, AB023049, AC006241, AC004228, AI035659, AC005081, AP000557, AI133448, AC004253, AC004263, AC004408, AC007279, AC007327, AC006538, AI109984, I35676, AI021394, AC004655, AC008394, AI031258, AC004167, AC005612, AC004491, U82828, AC005940, AI022165, AC005837, AB023050, AC006441, AI022318, AC005022, AI031589, AC007225, U41483, AC002418, AC005920, AC005759, AF017104, Z84480, Z93244, AI035684, AC005206, AC004232, AC006141, AI121748, AC007056, Z98044, U33956, AC005207, AC006050, AI035086, AF165926, AC005519, AI023584, AC005696, AP000511, AI023807, AC009516, AI031296, AI021391, AI033525, AC004472, AI121603, AC005695, Z85986, AC002551, AC005667, AP000502, AF111168, AC004148, AI049692, AI049869, U95742, AC018633, AI132774, AI034417, AC003982, AC004587, Z97353, AC003035, AI022476, AC003669, AC007308, AC007216, AI008726, AI022721, AI133289, AI133396, AI020993, AC006285, AC005535, AP000696, AC004900, AC005755, AF190465, Z69707, Z98750, AF134726, L44140, AC005049, AC002300, Z83826, AC005377, AI034420, AF002223, AC003684, AI050348, AI050325, AI049795, AI133163, AI031587, Z98946, AI031295, Z99496, AC002400, AC005899, AI024507, AC004895, AI246003, AP000212, AP000134, AC004884, AC004049, AC008125, AF047825, AC005368, AC005875, AF207550, AI035420, AI132712, AI080243, AP001053, AC005921, AC007238,
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HPMAH85	2060	783344	1 - 436	15 - 450		N24966, and AA369334.
HPMAH56	2061	867711	1 - 378	15 - 392		AI969185, AA369304, AA369303, AC002404, AL034417, and AL133163.
HPMAB10	2062	968723	1 - 538	15 - 552		AA400632, AA400317, AA513753, AI188727, AI148002, AI797479, AI090223, AI833007, AA676886, AA740345, AA536076, AI336523, AI191303, AA978356, AI017725, AI128273, AA639692, AA468753, AA724081, H27059, AI879456, AI500369, N41692, R07494, AA252085, AA368986, AI436367, AW363134, AA838338, AA947905, AA707248, AI199605, AA670492, AA633704, AA931186, AW081785, AI554783, AI432454, AA927473, AI886832, AI886932, AA542849, U75998, F34689, AI970899, AI865318, AI142293, F26406, R07547, AA811357, AI815926, AI815728, AA353038, and AI831322.
HPLBW22	2063	679217	1 - 271	15 - 285		AA101449, and AA368833.
HPLBW02	2064	921331	1 - 501	15 - 515		AA644353, AI305162, and AA368822.
HPLBT54	2065	731065	1 - 524	15 - 538		R77180, and AA368801.
HPLBT53	2066	728517	1 - 436	15 - 450		AA429609, AA368800, Z68274, and AL117391.
HPLBS41	2067	712707	1 - 546	15 - 560		W69937, W69806, AA368743, and AF086311.
HPLBQ96	2068	796069	1 - 208	15 - 222		AI950844, AA970836, AA368531, AI761793, AW071107, R68649, and C00439.
HPLBO90	2069	787208	1 - 352	15 - 366		AA404593, AI732819, AI821540, AA459410, AA368625, and AA404736.
HPLBN79	2070	781854	1 - 313	15 - 327		AA368571, AI565323, AI479183, and N49068.
HPLBB47	2071	975477	1 - 733	15 - 747		N40247, AA467841, AA467897, AA368245, AI017480, AA973025, AA860186, AA305650, AA305127, AA307746, AW067937, AW299379, AC005881, and AL023280.
HPLAX14	2072	727885	1 - 500	15 - 514		W69552, AA368102, R50327, W21480, AA477047, AW383764, AA356448, AA368997, AC005071, AF161081, and AF161080.
HPLAV44	2073	715732	1 - 481	15 - 495		H53753, AW386067, AA367999, H63477, and AC003006.
HPLAI10	2074	968707	1 - 562	15 - 576		AI128337, AA572738, and AA367352.
HPJFA10	2075	963322	1 - 594	15 - 608		AI810835, and AI817587.
HPJEV95	2076	929723	1 - 515	15 - 529		AA159265.
HPJEU01	2077	928408	1 - 359	15 - 373		RI9571, AA468022, AA583898, AW364981, AI872020, AW276817, AA469451, AA828749, AL119691, AA169263, AA502860, AI110688, AA501821, AA580808, AI801600, AW303196,

AI699710, AW274349, AA665021, AA362698, AA806796, AA724333, AA508034, AL042853,
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 AC008040, AC005246, AL031681, AL049757, AC005019, AC006207, AP000105, AP000037,

HPJET11	2078	965894	1 - 588	15 - 602	AC004848, AF015148, AC005191, AC004584, AB020859, U67211, AP000043, AP000111, AC004975, AC004028, Z99716, AL035587, AC002430, AC007041, Z98744, Z83826, Z49235, AL031255, AL009029, AC004686, AL050333, AP000556, AL109985, AC004943, AC007537, AC000085, AC003962, X55933, AC003109, AC005154, AC002365, AC007384, AL079303, AC004913, AP000095, AL035458, AL078593, AC007165, AJ229042, AC005871, AL137100, AL031285, AF165926, AF042090, AL132992, AC006254, AC008055, AL049795, AC005015, AC002067, AC009411, AC002379, AL031733, Z98745, AL035681, AC008115, AC005225, AC005412, AC000025, U35114, AF161800, AC005193, AJ006996, AL031589, AC002041, AJ246003, AC004994, AR036572, U91328, AC003691, AL136018, AC004838, AP000239, AL031277, Z54246, AC004796, AP000953, AC003665, AC008127, AC004098, AC002565, AC003684, AF112482, AL132799, AF165138, AP000432, AC005772, AC004562, AC005235, AC005230, AC006004, AC005488, AL035423, AC005678, AC006155, AL109829, AC007207, AC002476, AL049776, AC004019, AL078603, AC007064, AC016025, AL031577, AL031230, Z69719, AC000004, AC004033, Z69917, AL096771, AC004638, AC006130, AL022302, AC006597, U47924, AC004895, U95742, AC006241, AL031904, AL022724, AL021155, AC002564, AC005011, AL078581, AC007285, AC002402, AF146191, AL109865, AC007676, AP000352, AC004057, Z98753, AP000555, AC006482, AP000965, AL021154, AL049832, AL035530, AC007632, AC006026, and AB023051.
HPJET17	2079	859867	1 - 426	15 - 440	N62272, and AL049662.
HPJEL02	2080	918315	1 - 318	15 - 332	AL469935, AA035546, R54113, T27117, and H41850.
HPJEG53	2081	974074	1 - 505	15 - 519	AA001172, and AC006987.
HPJDW93	2082	867759	1 - 715	15 - 729	AC006137, and AC007160.
HPJDT03	2083	922815	1 - 388	15 - 402	AA213989, and AW016127.
HPJDP54	2084	949149	1 - 287	15 - 301	AA446260.
HPJDF61	2085	889928	1 - 757	15 - 771	AA621949, and AI935081.
					C14389, AA360910, H81346, D80195, C14014, D51423, D81026, D50979, C15076, D80164, D59467, D59502, D59275, D80193, D80227, D80038, D80166, D58283, D80022, D81030, D59859, D59619, C14331, D80210, D80391, D80240, D59787, D51799, D80253, T59438, D80043, D80269, D80212, U82828, AC005668, AF036405, AL096867, AC005300, AL050306, AC007688, AC008044, AC007052, AC004967, AC005071, AC004913, AL031666, AC007276, AC006509, AJ003147, AP000502, AL109657, AC003041, AC005529, AF023268, AL080243, D88547, AC004990, AC020663, AC003071, AC004223, AC005829, AF053356, AC005821, AC004150, AF134726, and AC010206.
HPJDC01	2086	915056	1 - 470	15 - 484	AI279943.
HPJDA25	2087	951281	1 - 572	15 - 586	AW408615, AI815752, AI906637, and AF047690.
HPJCU29	2088	928407	1 - 615	15 - 629	AW339568, AA525000, AW087208, AI284640, AA350859, AI471481, AA649642, AW276827.

AW193265, N25296, AA469451, AA829223, AL046409, AI061334, AI049634, AI350211, AW193432, T07451, AI688846, AI289067, AI341664, AI431303, AA491814, AL041412, AI613280, AI887483, W79504, AI619997, AI375710, AI340453, AI754658, F36273, AA664535, AI134367, AI345654, AI017024, AI344844, AI963720, AI814735, AA594145, AA568778, AI830390, AA394271, AW338086, AI064864, AI281881, AI334443, AA551503, AI053672, AW303196, AW274349, AA810370, AW438643, AI446464, AA831375, AF150152, AI871722, AI298710, AA630030, AA714453, AA598824, AW301350, AI623898, AI133164, AA719805, AW410400, AA652764, AW166815, AW029038, AL041690, AA126051, AA126035, AA610491, AI434695, AI537955, AA526342, AI754955, AW406162, AI379719, AI888008, AI085719, AA486414, AI270117, AI962050, AA652057, AI801600, AA771811, AI708009, AI732186, AW303876, AW162049, AI929531, AA598586, AI610159, AA713815, AW265009, AA470969, AA581903, AI821271, AW276817, AI679782, AI133102, AW088846, AW439558, AA191620, AW269488, F29989, AI339850, AI291268, AI291124, AW406755, AW419262, AA521323, AI282832, AL044940, AA513181, AI567674, AW302013, AL138455, AI341548, AI110770, AI471543, AI133636, AA522942, AA582911, AA644538, AI251002, AI499134, AI963095, AA862173, AA730684, AW339687, AI358343, AL038785, AW265385, AA491831, AI151261, AI499938, AF150222, AA634146, AA682912, AI358229, AI281697, AI367497, AW008317, AI160117, AA587604, AW104748, AA542991, AI357551, AL138265, AA678436, AI287651, AA323749, AA649705, AI561060, AL120674, AI745325, AL048925, C05986, AI148277, AI859742, AI625244, AI761471, AW270270, AI457397, F19012, AA084070, AL119691, AI281903, AW440836, AW406447, AI143242, AA623002, AA602528, AA837084, AW272758, AW157005, AI937850, AA111909, AA531372, AI801591, AI365988, C75026, AA569387, AI669453, AW162489, AW088058, T06828, AA644551, AA487858, AA665742, AW008952, AA569205, AA071144, AA148489, AA348311, AI469003, AI590689, AI590958, AI262909, AA302963, AA599920, AI279165, AA703820, AI371070, AI951889, AI245679, AI653886, AI866908, AW148792, AI471487, AI561255, F23205, AI801482, AI873916, AA577906, AL120687, AA837351, AA729721, AI744995, AA521399, AA92126, AW071196, AA977743, AI683577, AW276435, AI539563, AI828208, AL079645, AI570261, AI917271, AW243960, AI635818, AA721981, AI469624, F01314, AI028510, N25042, AA492166, AI624142, AI749559, AI569086, AA488395, AW103758, AL049610, AL031283, AC004522, AC004901, AC005033, AL050342, AC006544, AL022161, AC004953, AF001549, AC002558, AL035541, AC004070, AP000244, AC007221, AC018769, Z84484, AI035494, AC004703, AC006543, AL022323, AC005821, AC003098, AC005829, AC005839, Z98941, AL031735, AL049554, U92032, AC002412, AC005482, Z84478, AC002300, AC009069, AC007240, AL109611, AC006559, AL034424, AL022320, AL080241, U69730, AC003690, AC004817, AC005682, AL035420, AC000086, AL008638, AL024498, AC007242, AL049611, Z82202,

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HPJCT81	2089	494874	1 - 401	15 - 415	T47764, AL240418, AL042373, AL680840, and T23659.
HPJCT26	2090	559949	1 - 628	15 - 642	
HPJCS73	2091	975087	1 - 540	15 - 554	AC009533, and AC008013.
HPJCS43	2092	715082	1 - 426	15 - 440	
HPJCS32	2093	699046	1 - 261	15 - 275	
HPJCN60	2094	887600	1 - 408	15 - 422	AC005754, and AF152495.
HPJCL55	2095	670083	1 - 580	15 - 594	AA460600, AA971933, AA461528, AL028767, AW104221, AL916255, AL807812, AL815321, AA609716, AA897273, and AA382975.
HPJBU40	2096	710928	1 - 411	15 - 425	T79399, T79485, and AC004460.
HPJBU09	2097	625362	1 - 520	15 - 534	H14685, H11846, and Z42042.
HPJBS74	2098	765390	1 - 579	15 - 593	AA199800.
HPJBS52	2099	726535	1 - 505	15 - 519	R69458.

HPJBS35	2100	867818	1 - 427	15 - 441	R08072.
HPJBL76	2101	769889	1 - 764	15 - 778	N20501, W21595, AA971971, A1017087, AA782105, A1924135, and AC007066.
HPJBL30	2102	948721	1 - 1114	15 - 1128	A1743553, A1458005, AA855142, A1808388, A1808190, AA854848, A1167631, A1458852, A1740975, A1184926, A1027358, A1084343, A1041477, A1860979, AA782086, A1864309, AA58255, and AL035562.
HPJBK25	2103	974606	1 - 199	15 - 213	
HPJBK14	2104	974593	1 - 317	15 - 331	Z98272, and AC005202.
HPJBH45	2105	717088	1 - 391	15 - 405	H02676, R21208, and AC006480.
HPJAX30	2106	607408	1 - 748	15 - 762	
HPJAU73	2107	806718	1 - 306	15 - 320	W04456, H09371, D59238, H09370, N34243, AA091691, and N75681.
HPJAP92	2108	887830	1 - 416	15 - 430	Z97832.
HPJAO13	2109	824243	1 - 895	15 - 909	A1284640, A1801600, AA745582, AA491814, A1350211, AA745431, A1902694, AW080134, A1053672, AL133723, AW193265, A1688846, A1446464, AA492132, AA985038, AA747480, AA350859, AA318652, A1286356, A1471543, A1679045, AA649642, A1610159, AA503258, H64777, AA515435, A1761471, A1469624, T07451, A1281697, A1251002, A1205126, F25276, AA977743, AA515751, AA559290, A1281881, AW419262, A1610376, AW276435, AA678436, AA747276, AW088058, AW274349, A1648558, F29989, A1061334, AA605274, AA747472, F36273, A1962050, A1287651, AA553465, A1264743, A1344844, A1198376, AA377730, AA483034, AA650244, AA469451, A1312149, A1049634, AA745560, A1918421, A1471481, AW103981, A1937850, AA490165, A1768952, AA659083, A1367975, AA594145, F18974, A1245679, AA364224, AA365302, AA680243, A1286264, A1624698, AW440976, AA441788, T40338, AW236342, AA521323, AA557879, AA843450, AW265170, A1287964, AW029038, AL046409, F31204, F28776, F37169, H64560, A1305547, AW193432, A1339850, A1963720, T53607, A1929531, AL120483, AA347927, AA708678, A1282832, A1358571, R91994, A1904894, AW243960, A1358343, AW243698, A1184226, AW166815, AA657918, AA515051, F23279, AL045182, A1355206, AW264973, A1919029, A1431303, F33566, AW276827, AA347930, F37286, AW303196, AA886584, AA244415, A1206785, N43757, AA302963, AA482711, AA338486, A1270117, AA501722, AA229785, A1821271, AA503154, AA669840, F35673, AA557686, A1653905, N71930, AW272758, AW301350, AA358122, AA654771, F34558, AW104748, AW406755, AA664535, AA100372, AA084070, AA810318, AW265654, AA364456, A1924251, AW261871, AA682912, AW088202, H41319, T08638, A1619997, AW162049, A1832782, A1633007, Z98473, AA581903, A1358501, AA669251, AA394271, A1365988, A1569086, F28576, A1083946, A1963095, AA610491, A1866956, A1299050, F28204, T06783, AW238278, A1692265, A1802526, A1358229, AA515224, T40617, T29180, A1083998, AL119691, AA528516, A1309740, T40077, F26152, C75026, A1709365, A1133636, A1081095, AF150152, AA715609, A1567674, AC004076, AF019664, D83989, X75335, AC007446.

AC005598, U57007, I51997, AL031680, AL008725, M87916, AP000297, X55925, U57009, U14718, U80017, AC009498, Z30979, M37551, AF015152, U18394, AP001035, X55928, X54180, U18391, U18392, U57006, U18393, U57005, U18390, AL049776, S75337, M87919, AC005546, U18399, S70697, X55924, U18398, AL035448, Z81370, AC006942, AL031118, X55932, AL023553, AC005291, AL109801, AC006205, U18395, AC006537, AC005032, AC005790, AC005335, X54181, X54178, X55931, U57008, AC006251, X54175, S70707, S70694, U02058, U02054, U02063, Z93016, AC005028, U14716, AF147277, AP000044, AB020859, AP000112, AB024685, U14719, U14713, AL031577, AC007386, AL035458, AC005284, AF077058, AC003954, U14710, AC002038, X55922, U14714, AC005019, X55926, AL031650, Z75888, U18387, X55930, AC005912, U14711, U14712, AC011198, AC005614, U95740, U14706, AP000306, AC005193, AC007298, Z94721, U14695, U14705, Z75887, U14702, U14689, U14691, U14685, U14686, U18396, AP000047, AC007370, AB023057, AC002564, U02048, AC009069, AP000520, AC005565, D26067, Z84474, M87918, U72787, AC007216, AC005251, AP000115, AC005815, AC000387, U14715, AC004020, AC004263, AC005069, D87000, U14703, S70699, AL031427, U95742, AL022154, U47924, AC008115, AB020668, S77605, AF055066, AF015156, AC006208, X54179, U14699, U14687, U14688, U14692, AP000553, AL139054, AC009516, AC004964, AC006211, AC004193, AC004659, AC008071, AL132992, AC002404, AC004957, U62292, AC001164, AP000567, D89870, A39972, AC002544, Z85987, AL133404, Z92845, AC005250, AC008079, AF139813, Z82195, U14717, AL034553, AL110120, AL031714, AC006285, AC004990, AC005592, AL031054, AL035209, AC006336, AL023513, U67221, X54177, AL035450, AC007099, AL035551, AL050318, AC004453, AC006204, AC004854, Z98744, AC004638, AC007012, AP001172, U18400, AF015160, Z84814, AC004637, AL031602, AC005838, AC004813, AC004019, AF015153, Z98043, AC004878, AC006152, AC005360, AC004765, U63721, AC003982, AC004187, AC006511, AC005071, AL034549, AC006207, AC005104, U14700, AC010436, AC005993, AC004152, AL021546, U14690, AL049633, AC004890, Z31005, Z82208, AF015155, AP000252, AL133399, AC005670, AC007312, AC007243, AC008101, AC007043, U73684, AL021977, AC004477, AL121603, AC007617, Z75746, U34879, U91326, AL034548, and AL049781.				
HPJAN69	2110	754858	1 - 346	15 - 360
HPJAN67	2111	751384	1 - 308	15 - 322
HPJAN57	2112	734503	1 - 239	15 - 253
HPJAJ20	2113	669000	1 - 754	15 - 768
HPJAE51	2114	725761	1 - 564	15 - 578
AA961913, A1088134, AW263056, A1923972, AW205741, W19869, AC004962, and AL049431.				
AL133246.				
R11971.				
H16572, AW241811, H18666, AW241812, AW129128, AW009414, AA553981, AA876116, A1243349, AA757971, AL035696, AC004842, AF020802, AP000687, AJ229041, AL035252,				

HPJAA27	2115	419786	1 - 348	15 - 362	AC005908, AL009179, and AL022324.
HPICG93	2116	887817	1 - 434	15 - 448	E17067, and E17068.
HPICE06	2117	935095	1 - 804	15 - 818	H97402, R51737, N69864, and N24204.
HPIBY36	2118	708183	1 - 504	15 - 518	H08396, R25790, N53251, N51204, Z42071, and AP001115.
HPIBT62	2119	743135	1 - 475	15 - 489	R23515, N76536, T74959, F12749, A1961429, F11571, and AAG40294.
HPIBO89	2120	786741	1 - 459	15 - 473	H96715, W90749, R49610, AA983768, AA904877, AA677746, R38813, and AL133095.
HPIBI89	2121	867845	1 - 426	15 - 440	R99003.
HPIBH31	2122	838809	1 - 428	15 - 442	H73369, N34255, AW160399, H79944, AW239079, AA132425, R20300, H73299, N30499, AW407963, H70394, R97376, W52852, AA182911, AW407596, AA302225, N43927, W19497, T70776, W31972, N42142, T85051, N23533, AA093843, AA303409, AA312807, AA045678, W80575, AA326688, A1245848, AA035464, AA329750, AA229940, AW175673, W07289, AA332809, A1631124, AA372693, R07414, AW407906, R57473, AA299454, AA455701, N55991, AA230126, H03161, AA223846, AW205900, H96200, AA364785, AA467792, AA035465, AA307572, AA024761, C00198, W76420, AA176320, AA120782, A1719711, A1719084, A1453530, AW162019, AW173349, A1984009, A1088520, AA639784, AA127810, and AL024498.
HPIBC93	2123	785971	1 - 426	15 - 440	A1814342, AW001123, A1924201, A1935359, AA888820, A1366738, AA665651, AW134874, AA252373, AA766826, A1198343, AA670436, H42655, H62371, A1763375, Z97630, AF077740, Z79834, Z79925, Z58542, and Z58541.
HPIBB45	2124	867850	1 - 165	15 - 179	
HPIBB43	2125	715037	1 - 234	15 - 248	
HPIBB32	2126	698901	1 - 172	15 - 186	AL021366, and AL050332.
HPIBB19	2127	668489	1 - 405	15 - 419	
HPIAW91	2128	790033	1 - 713	15 - 727	A1690139, A1697496, N91409, N69381, A1695286, AC004200, AP000519, AB023056, and AF055066.
HPIAV06	2129	935111	1 - 373	15 - 387	AA600329, A1061271, A1609972, AA573000, AA551268, A1580707, AA665532, A1306717, AL138199, AA502207, AA302661, AA295865, AA295874, AA838091, AA378489, AA779783, T40629, AA601343, AA577824, AA665187, A1520967, A1452836, AA526424, AA553579, H25938, AA599080, A1417586, H47201, AA318116, AW084173, AL037777, AA349606, AA320521, C16718, N94325, AW236288, A1494417, R70884, AA099840, AL137946, A1921706, AA172191, AA349937, AL041375, AA719523, A1819391, AA262752, AA009855, AA551400, AA468196, A1932900, AA552966, A1570943, N91711, AA468247, AA810154, AA552202, AA137274, AL042373, A1889579, AA659656, T94140, N75708, Z97353, AC007707, Z98941, AL034429, AL109984, AL132642, AL035685, AC007934, AP001038, AB023048, AL035106, AC022517, AC004259, AC004967, AL132987, AL021395, AL035457.

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HPIAQ70	2130	973604	1 - 507	15 - 521	AL043020, T66111, T74122, R53143, R20480, R05568, F12380, H05013, and Z92544.
HPIAP79	2131	774817	1 - 499	15 - 513	AA601278, A1791227, AL121287, AW069227, A1307201, AW168433, AA578621, AA587516, AW404225, AA832145, A1285578, A1309943, A1634187, A1590404, T08386, A1890794,
HPIAD10	2132	906987	1 - 1270	15 - 1284	AC005233, AL031983, AC003999, AL021026, AC006137, AC007182, AC007298, AC007685, AL079342, Z82188, AL118497, Z92547, Z68756, AP000322, AL021978, AP000121, AL021154, AC003010, AF109907, AC004887, AC003964, AL031767, AC006210, AC007388, AP000053,

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HPHSB91	2133	790313	1 - 307	15 - 321	
HPHSB21	2134	671118	1 - 401	15 - 415	
HPHSA94	2135	793084	1 - 196	15 - 210	
HPHAE81	2136	778036	1 - 404	15 - 418	AI674979, AI493794, AI261833, AI478181, AW300149, AI769515, AI373263, R07018, AI672274, AW301213, AW301193, AA910740, AJ249199, and AF141289.
HPFMG06	2137	933696	1 - 209	15 - 223	AA165204.
HPFMB10	2138	961758	1 - 670	15 - 684	AA548727, Z28355, AI557262, AA585439, Z30131, AI557731, AI535639, AA585101, AI525306, AI557238, AI525556, AI536138, AI557807, AI541307, AI526194, AI541205, AI541365, D61254, T11028, AA585453, AI546945, AI525316, AI541415, AI541535, AI547039, AI546999, R28735, C16300, AI535813, AI535660, AI541374, D57491, AI541390, AI541013, AI557787, AI525431, R29445, AI541510, AL041346, AL041096, AL047012, AL041358.

AL041277, AL041163, AL041098, AL040621, AL043538, AL041324, AL040464, AL044162, AL041086, AL043496, AL041296, AL041233, AL041140, AL040193, T23985, AA585476, AI540967, AA585155, AL040149, AA585434, AI557808, R29218, AI557082, AI557799, AI541346, AL040155, AL043444, AI541523, AL044529, AI526140, AI557796, T18597, AL041197, AL041347, AL043612, AL045725, AI546855, R29177, AL039915, AA174170, AL040463, AL047219, AL041227, AL047057, AL047170, AL040119, AL047036, AL080031, AL041292, AL041051, AL047183, AL040322, AL041131, AL046330, R45895, AL041133, AI546828, AL041238, AL041142, AL045817, AI546875, AI556967, AL040529, AL040625, AL040510, D55233, AL043467, AL044186, AL044037, AL040091, AL040128, AL040168, AL040255, AL040285, AL040342, AL040332, AL040553, AL040617, AL045684, AL041159, AL040745, AL040370, AL043677, AL046442, AA585440, AL040839, AL041752, D61185, AL043775, AL044165, AI557727, AL043492, AL041602, AL045920, C16305, AL038838, AL040253, AL044074, AL041635, AL045990, AL040458, D53447, AL044199, AL044187, AL040090, AL040263, AL040294, AL040329, AI525856, AL040082, AL044272, AL040444, AL041186, AL040148, D59436, AL043537, AL041730, AL041523, AL043627, AL041246, AL046392, AL041374, AL040576, AL040052, AI525500, AL043845, AI557740, D59751, AL042096, AL039338, AL042135, AL044064, AL038983, AL039316, AL043923, AL043814, AL043848, AL045753, AL041459, AL043570, AL041577, AL044201, AL044258, AL046850, C14391, AL038532, AL040768, AL037727, AL044274, AL045857, AL079878, AL049018, Z32822, AL046994, AL040414, AL040571, AL046914, R28967, AI142134, AL038822, AI526184, AL040238, AI557734, AL046327, AL134524, AI541508, AL041168, AA585098, AI557763, AL049069, AI525320, AI540974, AI524891, AA283326, AL045671, T41289, AI557279, AL040472, R28965, AI546891, C16293, R28892, R28895, AI557864, AI546829, AL037335, AL039744, AL041278, AL045989, AI541027, AI547006, AL037343, D60765, AI541514, AI557802, AA585329, AL039360, AI541356, AI541534, AA170832, AL040075, AI038761, AI546996, D57186, AL041955, AI526187, AL046147, A25909, AR062871, AR038855, A85395, A85476, AF082186, AJ244004, AJ244005, X81969, AJ244003, AR037157, AR062872, AR062873, A20702, AR017907, A20700, A43189, A43188, I44681, AJ244007, AR038762, A98767, A93963, A93964, I63120, A98420, A98423, A98432, A98436, A98417, A98427, I15717, I08396, I15718, A93016, I08395, Z32836, X83865, AR008429, Y16359, A86792, A84772, Y09813, A84776, A84773, A84775, I18895, A84774, AR067731, AR054109, AJ230935, A58524, AR067732, A58523, A58522, A91750, M28262, D78345, E03627, I13349, I48927, AJ230902, A60212, U94592, A60209, A60210, I03331, A60211, A18053, I84553, I62368, I06859, I84554, AR031566, A02712, I00682, A77094, A77095, A81878, A95051, A11623, E00609, A11624, D50010, AF149828, A18050, A23334, A75888, I70384, A64973, A90655, A60111, A23633, AR007512, I13740, A70872, A11178, E01007,

HPFDX38	2139	709302	1 - 571	15 - 585	A10361, AR043601, A02710, E12615, AJ230972, AR035193, A92133, E14304, A07700, A13392, A13393, AR031488, I13521, AJ230951, I52048, A27396, E16678, AR027100, I49890, I44531, I28266, A35536, A35537, I21869, A02135, A04663, A02136, A04664, A91965, A95117, I44516, A70040, A82653, AR038066, A24783, A24782, E16636, A11245, A70869, A20699, E00696, I60241, I60242, AR009151, E00697, I66485, I01995, I66487, E03813, AJ231009, I66482, I66483, I66484, I66498, I66497, I66496, I25027, AR027099, I66486, I26929, I44515, I26928, I26930, I26927, I08051, I05558, AR051652, AR051651, I19525, I08389, D13509, A22738, D13316, AB025273, AJ230867, AJ231028, AC005913, AR051957, E17098, I66495, I66494, A22734, AR064707, AR054723, AR035975, AR035977, AJ230845, AF006072, AR022273, AJ231011, AR035974, AR035976, AR035978, X55486, U87250, AR050070, A06631, X82786, S60422, AR051865, A62298, X07299, Z30183, E12584, A82595, A82593, AR063812, AR051864, I36244, AJ243486, Y14219, X76012, I05845, AR031358, AR031365, AJ230996, AJ244006, I03669, I03668, A16035, AR017826, A62300, X82834, AR003381, I33632, E03654, AF213384, Y08991, A22739, AJ131952, AF135243, AB005666, AR009152, S68736, and L36913.
HPFCZ82	2140	780198	1 - 509	15 - 523	AA649151, AA251443, AW080521, A1261734, and AA761257.
HPFCZ60	2141	430125	1 - 477	15 - 491	W73400, W73375, AA550828, AF086321, and AC008042.
HPFCZ10	2142	968360	1 - 308	15 - 322	N27955.
HPFCR23	2143	675120	1 - 432	15 - 446	H01127, and AI696650.
HPFCP82	2144	867881	1 - 675	15 - 689	AW023111, AW021917, AI635440, AI800180, AW328331, AA714110, AI800168, AI962030, AL046519, AW237905, AI887235, AA297145, AA129746, AI792521, AA831638, AI440117, AI687343, AW270255, AI491765, AI799607, AL119691, AI821931, AW419389, AW275432, AI755057, AW008169, AI254959, AI792499, AA528503, AA773463, AW238253, AI380617, AL119247, AA456924, AI345132, AA502532, AI267269, AL037714, AW189113, AA837686, AI278972, T05118, AI753672, AI279417, AI889795, AI889804, AI732789, AA284247, AW157456, AI874341, AA433894, AW162697, AI369580, AI445934, AI912401, AL135357, AI284543, AI250552, T74524, AW168420, AW410354, AA828637, AI144055, AA397389, H38769, AA314891, AW238484, AA864603, AW407632, AA618316, AI053793, T49633, AI362442, AI560085, AI251034, AI206841, AC005913, AC007327, AL035090, AL022320, AC005082, AC004805, AL078477, AL031846, AC004659, AC007193, AC007216, AC007011, AC007363, U95742, AL023580, AC000052, AC004025, AC005022, AL133353, AC004877, AC007277, AL031053, AC007684, AL035073, AL049830, AL031186, AL031297, AC003991, AC007919, AP000080, AC007425, AC005730, AC004019, AC004531, AC004673, AF134471, AC006064, AC004796, AR038762, AL049570, AL050332, AC007151, AC007738, AL049557, AC007546, AC006153, AC004053, AF031078, AC006581, AF030876, AC005736, AF181896,

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HPFCP53	2145	526574	1 - 487	15 - 501	H66573, AA381762, AL689019, H54210, AA563770, AA664604, AI244254, AW021116, AI500552, AA130647, AA879053, AI275183, AA669706, H64777, AA367788, AA468486, AA604843, AI588856, N45421, AA573213, H93293, AA310557, AI004591, F02412, AI623563, AI270476, AW168483, T08421, AI309384, AA448838, AI803809, N67387, H55894, AA837715, AI471691, AA298386, AA599495, AI473701, AI279759, AA904275, AI627581, F02421, AI440324, AI598060, AI754291, R92640, AI471572, T03203, AA574286, AI357551, AI885572, AW189353, AA650447, AW168479, AI271762, AI305258, AI360514, AI609223, AL046746, AA669709, AI687962, N38789, AI076236, AA847099, AI821044, AA669102, AA487542, AA679872, AA491484, AA077776, F17700, AA086318, AI561116, AA378683, AA558344, M78007, AA365586, AW079809, AA613627, AI889579, W95503, T94116, H96518, AW270256, AW404844, H44786, AI915081, AA664283, AL045709, AA640979, AC012627,

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HPFCM45	2146	723501	1 - 537	15 - 551	HI4121, AI375113, AA744592, AA960851, AI298360, AW293609, AW386311, AW386307, AW379359, and AW386340.
HPFCM27	2147	682098	1 - 537	15 - 551	AI126345, N75862, and N22068.
HPFCL56	2148	732601	1 - 343	15 - 357	AA424616, AW206710, W48815, and AA284281.
HPFCL24	2149	867889	1 - 321	15 - 335	AI741779, AI203371, AA464709, AA725428, AA771747, U25770, and AA725175.
HPFCG02	2150	921196	1 - 376	15 - 390	H66442, and AC005484.

HPFCA01	2151	928672	1 - 412	15 - 426	T95327, AI823904, AW206324, T95680, AI369869, AI939557, and AC005531.
HPELD12	2152	969248	1 - 671	15 - 685	AI801883, AA782908, AA026115, and AA770002.
HPEKI04	2153	926104	1 - 413	15 - 427	T77896, T77813, and AA009652.
HPEKE01	2154	914414	1 - 521	15 - 535	AA977210, AI589896, AI198170, and AI557234.
HPEBT82	2155	524246	1 - 146	15 - 160	AL040143, AA747480, C06327, AA747276, AI888365, AA502103, AA132553, AW303196, AW301350, AA310158, AW274349, AL079433, AI865364, AA747375, AI537185, AI890348, AA828704, AI434706, AI536146, AI370475, AL042420, AI306028, AC004972, AL132987, AC006017, AC004812, AC007226, AL031721, AF196779, AC002553, AL034429, AC006057, AC006965, AP001051, AC006449, AC003043, AL031650, Z83849, AC007064, AL133245, AC006160, AC006277, AC004884, AC002558, AL031602, AL132992, AL035361, AC005233, AP000556, Z98200, AC007052, AC002429, AC007546, AC018633, AC005844, L44140, AL050341, U66059, AC005250, AC002492, Z99716, AC004585, AC004028, AL021939, Z83840, AC007878, AL049757, AC005562, AL031848, AC003695, AC005324, AC007773, AC003957, AC005548, AL049776, AC008039, AC006548, AC003037, AC002485, AC005321, AC005231, AC005771, AF111167, AL049872, AP000111, AL035460, AP000961, AL133297, AL031662, AC009247, AC016025, AC005412, AC002301, AC002041, AC000081, AC007536, AL023803, AC004861, AP000557, AC009516, AC004466, AC005358, AC008045, AL008718, AL031280, Y14768, AF117829, AC007686, AC004149, AC004217, AC005971, AC003007, AB003151, AC004647, AC004150, AP000505, Z86090, AC008372, AC006362, AC002316, AC005759, AJ003147, AC002404, AC005566, AC004890, AP000501, AL133289, AC010077, AC007040, AL022329, AL022397, AF196969, AC006039, AL121603, AL023577, Z82244, Z97196, AC005632, AC005808, AC007421, AC006285, AP000344, AC009479, AC005037, AC007537, AC000353, AC005089, AL031123, AC004460, AC004913, AC004019, AP000018, AC000003, AL133163, Z95115, AC006486, and AC007227.
HPEBT78	2156	773844	1 - 136	15 - 150	AW339853, AW188119, AI991660, AI369596, AI494519, and N39086.
HPEBT68	2157	753692	1 - 233	15 - 247	T40308, AA584201, AI732378, AI872020, AW327868, AA679936, AL042853, AA847952, AA828749, AA581903, AI270559, AA478355, AL119691, AA515549, AI580250, AI963720, AW265385, AA531186, AW274349, AW002350, AA580808, AI457397, AA618452, AA503600, AI284640, AI696962, AA640410, AA640430, AI908730, AA847499, AA015846, AA682912, AI783581, AI345518, AA806796, AI754955, AW131208, AI583283, AL046409, AI358571, AL121336, AA610688, AI369580, AI732120, AW303196, AA658362, AW022406, AW264934, AA503475, AW419262, AW088846, AA631480, AI677645, AI589230, AL043719, AA623002, AI632991, AL046457, AA680243, AW301350, AA613203, AI521062, AW075511, AI350211, AA720702, AI568678, AL036037, AA483256, AL121235, AA812281, AA532700, AA491284, AA846952, AA724333, AA533303, AI431303, AI471887, AA493708, AF034184, AI570261, AW023149, AI754253, AW157608, AI745325, AA358409, AI041146, AA491814,

HPBT54	2158	731002	1 - 385	15 - 399	AA503258, A1687343, AA490183, AW151713, A1298710, AA503039, A1281881, M37551, U57007, AC006039, AC006207, AC004834, AC006285, U73634, AC005531, AP000567, AL020997, AC004797, AC006539, AC007226, Z68756, AC006037, AC005598, AL121655, AL031281, AC007050, AC005081, AC005913, AC006238, AL049766, AC016025, AC007216, AC004848, AC005191, AL080243, AF161800, AC004990, AL021368, AC000353, AC007685, X75335, D83989, L49046, Z86090, AL021978, AC005754, AC005180, AF002223, AC006538, AL132992, AP000009, AC007845, AL117258, AL078621, U57004, AC005701, AL021878, AC006057, AC007160, AL023494, AB004907, U91322, AC004678, AL009028, AC004002, AC015853, AC005666, AC007370, AC004150, AC002504, AF165926, AF038458, AC004895, AL033392, AC005863, AC006449, AC005274, AC005520, AC004596, AL049759, AL022326, AB023049, AC003109, AL133163, AL022320, AF002992, U07000, AC008079, AL096808, AP000225, AL022311, AC012599, AL031722, AC008080, Z84721, AC007731, AC002465, AC005102, AC007043, AC005379, AC005500, AC000024, AL049633, AP000354, AL031255, AC004236, AL133245, AC006075, AC004556, AC006160, U57008, AL021877, AF217403, AC004021, AC007999, AL135744, AC005363, AP000556, AC005037, AC005067, AC004913, U91328, AL132712, AC004019, AL078603, AC005255, AC004643, AC002301, U82696, AC005242, AL031657, AC005258, AL049539, AC005632, AC004638, U95742, AC016026, AC004671, AJ246003, AP000150, AC005566, AC006011, AC004638, U95742, AC016026, AC004671, Z82190, AC006023, AC006270, AL080238, AC003075, AC007064, AC006597, AC006540, Z98050, Z95152, AC005071, D87008, AL109628, AC007537, AC004859, X69907, AC004944, AL049743, AC004485, AL035423, AC005091, AL034430, AC009247, AF015148, AC005015, AC006958, AP000344, Z98044, AL049696, AL132777, AP000356, AF045555, AC006474, AC004254, AL023876, AF015153, Z79997, AF042090, AL121658, AC010436, AC007751, AC005920, X55926, AP000114, AP000046, D83253, AC006042, AL133289, X54180, U18391, Z99754, U18392, U57006, U18394, U18395, X55925, U57005, X54179, AP000359, AL023879, AC006241, D88268, AC006453, X55929, AC003070, AC007066, X55933, AC005088, AC004854, AC003104, AC004802, AP000303, AP000557, AC005516, AC005399, AC009405, AC002395, AL049825, AL022724, AL133382, AL031228, AL035681, AL022328, AC005013, AC005600, AC002412, AC006327, Z95331, AC005212, Z98744, AC008041, AC004051, AC002067, AL035072, Z99716, AL109759, AP000563, AC007546, AL022322, AL034549, U67825, AL078611, AC004463, AL031587, and Z93930.
HPBT49	2159	530021	1 - 372	15 - 386	AC005089, AC005940, U91323, AC005666, AC007546, and AC003093.
HPBT34	2160	706836	1 - 358	15 - 372	
HPBT14	2161	535061	1 - 235	15 - 249	AW179046, AL133500, and AC003071.
HPBT07	2162	954214	1 - 303	15 - 317	AC002351, AC005875, AL022326, and AC006312.

HPEBO67	2163	578516	1 - 216	15 - 230	H78283, A1127890, AW090182, AW001838, W72897, and AF086351.
HPEBL08	2164	960240	1 - 408	15 - 422	A1021894, A1359246, A1422145, A1800895, A1689642, T89411, and AC007684.
HPEBH01	2165	921767	1 - 333	15 - 347	AA019103.
HPEBG89	2166	785942	1 - 505	15 - 519	AA425851, and AA425691.
HPEBG10	2167	867888	1 - 271	15 - 285	AA533740, and A1984425.
HPEBA89	2168	910250	1 - 490	15 - 504	AA758474.
HPEBA61	2169	742251	1 - 74	15 - 88	AC007036.
HPEBA05	2170	928027	1 - 357	15 - 371	A1217338.
HPEAG43	2171	468542	1 - 485	15 - 499	AA634147, AA837087, N63746, AC006197, AL031311, AC006079, AL035555, AC004790, AL031670, AL022727, AC002457, AL096803, AL049874, Z98048, AC005881, AC003663, and AE000659.
HPEAD72	2172	761472	1 - 371	15 - 385	H24817.
HPEAB12	2173	968847	1 - 498	15 - 512	A1656658, A1991597, A1962317, AW204277, and A1963904.
HPEAA57	2174	514231	1 - 441	15 - 455	AC008039.
HPEAA40	2175	867899	1 - 332	15 - 346	AA879011.
HPDWR11	2176	965249	1 - 629	15 - 643	A1694423, AA773635, AA443144, AA443143, A1918138, AW206226, A1337165, A1350411, N80841, W07349, AW197541, and AW138024.
HPDWN05	2177	928563	1 - 478	15 - 492	A1627858, A1674644, A1521975, AA653609, AA447670, R37708, H18650, and F34959.
HPDVM01	2178	913859	1 - 454	15 - 468	AA905449, AA969031, U62317, and AC005859.
HPDVD11	2179	965276	1 - 293	15 - 307	A1809869, and AA918215.
HPDRU11	2180	965307	1 - 346	15 - 360	N52071.
HPDRR06	2181	968601	1 - 436	15 - 450	AA806114, AW242125, A1249498, A1560615, A1274667, A1972210, Z28533, and AW361342.
HPDRN07	2182	951838	1 - 601	15 - 615	A1365618, A1197089, AW023975, A1570067, AW008217, H05066, A1828721, A1620666, H24331, A1684999, AA205931, AA601336, A1572680, A1921744, A1890297, AW338376, A1619994, AA171400, A1281622, A1174489, AA218684, AA878350, AA523812, AA579082, A1821342, AA935827, AW337817, A1860423, AW020102, AW021674, AW275432, A1889177, AA084320, A1798521, AA847341, AA507499, AA112864, A1434103, AA610644, AA557945, AA584241, A1819419, A1249365, H79277, A1000314, AA720582, AA493245, AA227713, AW157128, AA636077, A1254267, A1567676, A1538404, A1862716, AA135761, A1733523, AW021917, AA584489, A1969090, A1872229, A1813920, A1729188, AA629668, A1044966, A1038029, R64110, A1755214, A1754567, A1925588, R79396, A1114755, AA669238, A1734076, AA809546, AA733089, N99245, A1174827, W44797, A1857834, H47461, A1609992, N27340, AA618531, AA814719, AW149241, AW340905, AA826109, AA779599, AA598608, AA554289, AW028376, AA550989, A1148840, AW192930, AW069769, A1754105, C75332, A1439525, A1307563, A1049845, AA280886, A1135490, AA112646, AW023111, A1201983,

AA225141, AW277240, AW439224, AI123488, AW021847, N49298, AA525156, AW085626, AW162762, AA570255, AA834891, W69639, AA522864, AI803824, AA129000, AI003391, AA364147, AI282479, AI754926, AA573564, AI044701, AW189853, AA657808, AA182928, H54601, AA167656, M77888, T50676, F35684, AA702637, AA969564, W02419, AA342029, AW237905, AI791659, R61887, AA086042, AI732690, AI890857, AI732327, AA635150, AI815210, AI926876, N66744, AI459879, AI370470, AW083966, AI754257, AI932871, AA492496, R67038, AI587213, AA488419, AA714011, H59856, AI734075, AA772493, AA904211, AA633804, AW243817, AW070901, AI934664, AW419227, AA862312, AI446574, AI249688, AI921765, AW085811, AA100107, F23221, AA503298, AA640305, AI523356, AA470490, AA828840, AA653291, AA483606, AI537020, AC004263, AC006947, AP000359, AC005327, Z83844, AC007686, AC007055, AC006530, AC005015, AL049553, AF207955, AC006441, AL049780, AC004228, AC007540, AL035417, Y10196, AC001228, AP000510, AC005043, AL049709, AL034423, AC007030, AF195658, AC005081, Z97196, AL139054, AC007066, AC005519, Z99716, AL031587, AL136295, AC007308, AC006039, AC005529, AC007695, AL133246, AL020998, AC005412, AF111169, Z98044, AL049569, AC004999, AC005702, AC006241, AC004882, AL031291, AL031651, AL121657, AL021937, AC006312, AC004938, Z85987, AC004707, AC005180, Z82184, AL022165, AC004150, AC002352, AC004770, AC002470, AC004963, Z93241, AC004851, Z70289, AL031055, AC002310, AC005668, AC010200, AL035588, AC004974, AC004841, AL049776, AC006449, AC005280, U91321, AF001549, AC004477, AC002115, U91318, AL022312, Z99774, AC003025, AL034548, AC004973, AC005684, AC007227, Z93017, AC007151, AC004811, U91326, AC004605, AC005031, AC012384, AL031985, AF095725, AC000065, AF139813, AC006055, AL022314, AL031005, AC007207, U80017, Z98051, AL022330, AC005815, AC005005, AF207550, AC002347, AC004787, AL031284, AL035458, AC000025, AC006561, AC002544, AL022097, AC004797, AF196779, AC005377, AL117694, AL009181, AL121754, AL096712, M89651, AC005932, Z48051, AF047825, AC005838, AC007773, AC004032, AC005874, AF134471, Z98949, AP000501, AC005320, AL031664, AL035071, AB023049, Y18000, AC004832, AC007955, AC007917, AB023060, AC006581, U95739, AL035089, AC004169, AL031667, AC004825, AC004531, Z95115, AL034420, AC006511, AL031295, AC006560, AL031053, AF111167, AC005696, AC005220, AC005375, AC002059, AC006057, AL035422, AC003101, AL080312, AL109839, AC007225, AL049829, AL109984, AC004820, AP000558, AC005520, AL080243, AL008718, AC003104, AC004686, AL109627, AL133546, AL031666, Z95118, AL049872, AL050318, AC006162, AJ251973, U78027, AC004230, AC004887, AC002400, AC007011, AC006229, AC006450, AC004883, AC002375, AC004000, AF196971, AC005871, AE000658, AC002316, AC002369, Z97055, AC007016, AC006942, AP000555, AC004417, AL035461, AC004216, AL135960, AJ131016, AC007041, AL034554, AC003043,					
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HPDRG01	2183	914416	1 - 757	15 - 771		AW182845, R06052, AI34212, R05947, and Z61625.
HPDPS12	2184	969342	1 - 448	15 - 462		AA703816, AA258655, and AW173253.
HPDPP12	2185	969341	1 - 466	15 - 480		AA491958.
HPDPC08	2186	957822	1 - 443	15 - 457		AL043010.
HPDOW10	2187	961782	1 - 430	15 - 444		AI301598, AA889756, AA279491, AI301605, AA721450, and AL020997.
HPDOO10	2188	961881	1 - 754	15 - 768		AI939627, AI1199438, AI498865, Z99396, AW392670, AL036418, AL038837, AL037051, AL036725, AW384394, AL036858, AA631969, AW372827, AL119443, AW363220, AL119497, AL119483, AL039074, AL119319, AL119355, AL119457, AL119324, AL036924, U46349, AL119484, AL119363, AL119391, U46350, AL119522, U46341, U46351, AL119341, AL038509, AL119418, AL119335, AL039564, AL119396, AL039085, AL039156, AL039108, AL039109, AL039128, AL119496, U46347, AL037639, AL119444, AL134531, AL037094, AL039659, AL036196, AL036190, AL037205, AI142137, AL119439, U46346, AL042984, AL037526, AL134538, AL037085, AL038531, AL042614, AL036767, AL043029, AL037082, AL037077, AL036268, AL119399, AL042965, AL042975, AL134527, U46345, AL039625, AL039648, AL045337, AL038520, AL119488, AL042542, AL036238, AL038851, AL043019, AL042551, AL043033, AL038447, AL043011, AL042544, AL039678, AL039629, AL042450, AL039386, AL037615, AL043003, AL119464, AL036733, AL037027, AL037178, AL036774, AL036719, AL036998, AL039410, AL036679, AL036886, AL036765, AL036191, AL036158, AR060234, AR066494, A81671, AR023813, AR064707, AR069079, AB026436, and AR054110.
HPDOF11	2189	965491	1 - 870	15 - 884		AI939537, AI363373, and AL021997.
HPCTK02	2190	917480	1 - 434	15 - 448		N24908, AI916992, and N49979.
HPCTD03	2191	922149	1 - 361	15 - 375		AF150341, AI767747, AI972527, N85789, AI637774, AC001555, L81893, AC006077, and L81892.
HPCTC04	2192	925777	1 - 485	15 - 499		AI635931, AW241388, AI360647, AI218091, AI868064, AI824561, AC006198, and AL079338.
HPCQQ07	2193	951646	1 - 399	15 - 413		AI350228, AI792022, R20916, AI701465, AI457852, AI261722, AI741246, AF017104, and AC016831.
HPCPM63	2194	954940	1 - 483	15 - 497		AI131455, and AI761541.
HPCOV68	2195	911075	1 - 578	15 - 592		AA604716, R49364, and AC004500.
HPCAO89	2196	946913	1 - 464	15 - 478		
HPCAK66	2197	320415	1 - 331	15 - 345		

HPCAG81	2198	778177	1 - 388	15 - 402	R33353, AA482623, and AW237518.
HPCAF65	2199	573368	1 - 410	15 - 424	AW023975, AA610255, AA847622, AI223968, AA59080, AA132912, AA358086, AA736713, AI066711, H71678, AA744094, AA744048, AA551268, AA282951, AW151761, AA557945, AI537020, AL045476, AA515728, AI828721, AI025930, AI925065, AI823705, H12857, AW245354, AA856866, AI824476, W02497, AI46259, AI590404, AW104163, AW440368, N41775, AA984829, AA779783, AA847047, H40324, AA719523, AI078409, AI973173, AW088631, AA993636, AI636734, N90460, AI816537, AW129188, AA664604, AI471467, AI421755, T07327, AI282479, AI307563, AA747375, AC005484, AC002310, AC007376, AC006966, AC005913, AC002303, AI121769, AL031427, AF045555, AC006125, AC004522, AC006130, AL031657, AC005081, AL079295, AL049829, AF207550, AL031846, AC002418, AC004859, AC007371, AF196779, AL031431, AC004662, AC004386, AC004882, AC005225, AC002504, Z83844, AC005529, AL121653, Z97056, AC005695, AC004491, AC004813, Z98884, AC005972, Z68870, L44140, AC003108, Z98200, Z85987, AC005520, U82668, AL035658, AC001234, AC006449, AC005598, AL034400, AL031228, AL035684, AC007842, AL136295, AC004686, D86995, AC007227, AC007327, AC003010, AC000353, AC000025, AC005046, AC004834, AI132777, D87675, AC002302, AC002551, AC002128, AL109963, AL022476, AC007129, U91321, AL031276, Z98048, AC009501, AL135960, AJ131016, AC009542, AL008629, AF109907, AC004895, AC004477, AC002492, AL121603, AC005412, AL132987, AF134726, AC004876, AC005546, AC007664, AC007541, AP00011, AP000152, AC006088, AL049694, AC007766, AC004881, AC007358, AC002126, AC007216, AL031311, AC004134, AC005940, AC005971, AC005089, AC004099, AC003101, AC005277, AC007308, AC007551, AL049872, U78027, AL031283, AL078593, AC002470, AL022322, AC006064, AF011889, AC007565, AL135744, AL109613, AC005696, AC005383, AC007536, AL031230, AC005730, AL008735, AC004975, AL133448, AC009330, AC004851, AC007681, AC005821, AL034429, AC005736, AC004821, AC002425, AC003682, AC005666, AC007226, AC000134, U52112, AC002400, AC007193, AC008044, AC007283, AC006057, AC005531, AL031005, AF031075, AC004144, AC005015, AC006285, AL049757, AL022396, Z83843, AL096791, AL033527, AL022721, AP000048, AC006333, AL022165, AC006487, AL031287, AC004792, U62293, AC007263, U63721, Z83822, AC007999, AF017104, AC008015, U96629, AL024509, AC007298, AF111167, AC005519, AC002059, AP000115, AP000212, AP000134, AC006552, AC005537, AC004382, AF030876, AC005562, AC004596, AC005280, AC007546, AC002350, AL078611, AC006026, Z96776, AF030453, AC006241, AC016830, AL078476, AL021154, Z95115, AC004832, AL049539, AC004655, AL109623, AP000553, AC006006, AC006530, AC003043, AC007160, AL049748, AC005363, AC005527, AC006505, U10087, AC005071, AL078581, AL109758, AC006146, AC005486, AC016025, AJ009610, Z82180, AL035422, AC005082, AR036572, U91328, U91323, AL109627, AC005839, AL080250, AC005261,

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HOVEV01	2200	584754	1 - 1073	15 - 1087	
HPCAD17	2201	728857	1 - 395	15 - 409	
HPCAB54	2202	575233	1 - 233	15 - 247	
HPCAB45	2203	914553	1 - 721	15 - 735	

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HOVEU10	2204	961865	1 - 595	15 - 609	Z99396, AW392670, U46351, AL042450, AL043019, AL043033, U46341, U46350, AL119324, AL043008, AL119457, AL119335, AL042989, AL119401, AL134536, U46347, AL043029, AL134525, AL042614, AL043003, AL134531, and AR066494.
HOVEU06	2205	933737	1 - 324	15 - 338	W24148.
HOVEO04	2206	926209	1 - 165	15 - 179	
HOVEE20	2207	909030	1 - 432	15 - 446	
HOVDD82	2208	948619	1 - 514	15 - 528	N77523, AW371758, AA295628, AF150239, AA351493, and AF161544.
					AA814916, Z99396, AL036858, AL119319, AW392670, AL036924, AL036418, AL038837, AA631969, AL119443, AL037051, AL036725, AL037094, AW372827, AW384394, AL119497, AW363220, U46349, U46341, U46341, AL119341, AL037085, AL119483, AL039074, AL037639, AL119335, U46350, AL036196, AL057082, AL119457, AL119324, AL037077, U46345, AL119484, AL119363, AL119391, AL119355, U46346, AL134920, AL119522, AL119396, AL119418, AL042975, U46347, AL038509, AL119444, AL119496, AL039564,

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HOVDD10	2209	961887	1 - 391		15 - 405	N43177.
HOVCP77	2210	772210	1 - 604		15 - 618	R41728, H24352, R39867, R60774, F10382, R59965, R45695, Z38252, R42431, D81791, R45265, and F01387.
HOVCO50	2211	932544	1 - 572		15 - 586	AW235624, A1703030, W56086, AA442067, AA460968, AA478475, AA830981, AA767533, and A1193242.
HOVCN57	2212	734779	1 - 455		15 - 469	H44610.
HOVCM77	2213	772208	1 - 429		15 - 443	R61245, AP000495, and AC002076.
HOVCM03	2214	924196	1 - 304		15 - 318	A1193258.
HOVC189	2215	786917	1 - 321		15 - 335	AA36552, A1280208, AA885577, A1692637, A1435485, and Z99289.
HOVC108	2216	959470	1 - 1020		15 - 1034	AA634064, AW082209, AA781620, R50614, R53385, A1991409, AA035741, H39673, Z59735, Z54887, Z54886, and Z65048.
HOVCD33	2217	702445	1 - 315		15 - 329	R44210, and AL040454.
HOVCC57	2218	465313	1 - 393		15 - 407	A1347543, A1004448, and T40955.
HOVBQ07	2219	858863	1 - 591		15 - 605	AA52163, AA469920, AW205550, AW341591, A1742174, A1620502, AW027003, W91950, AW026996, W91877, A1215036, A1207964, and AA523613.
HOVBK69	2220	757594	1 - 411		15 - 425	AA436185, AW052178, H96098, AA653580, and AA416482.
HOVBK38	2221	956238	1 - 663		15 - 677	A1140254, AA948324, AA251283, AA862605, A1240375, AA825275, AA999858, A1301152, A1342674, AA011200, AA815310, W58239, AA931576, A1094483, A1302269, A1202732, AA649941, A1342676, R71253, AA449275, A1383771, A1831916, A1308112, R12392, AA525847, H52934, H06918, R34144, W58328, A1695242, R71305, AA876287, W89053, N93696, AA005209, AA251692, R34143, W89107, and AC006251.
HOVBK24	2222	858857	1 - 395		15 - 409	T96953, and T72381.
HOVBI67	2223	751665	1 - 861		15 - 875	A1040113, W87283, AA700434, W87282, and AC004975.
HOVBI20	2224	669730	1 - 215		15 - 229	H80446.
HOVAZ89	2225	904818	1 - 483		15 - 497	
HOVAZ65	2226	750273	1 - 445		15 - 459	AA406496, N46132, AA406518, and H96338.
HOVAY88	2227	827077	1 - 397		15 - 411	
HOVAY58	2228	736077	1 - 472		15 - 486	H01079.

HOVAY42	2229	713812	1 - 373	15 - 387	AL139054.
HOVAY03	2230	921959	1 - 276	15 - 290	AA062554, AI869336, AW170609, H13995, AA631622, H13997, H14028, AI569586, AA632137, and AC004143.
HOVAW62	2231	745704	1 - 234	15 - 248	H57248.
HOVAO25	2232	678163	1 - 361	15 - 375	T79639, N70408, N57728, T83855, AA001363, AI078086, T93794, and W03748.
HOVAN51	2233	725005	1 - 535	15 - 549	H26739, AI668579, AI733528, and AL020995.
HOVAJ07	2234	953422	1 - 438	15 - 452	AI031837, AI985078, T5928, AC003692, AL121973, AC004019, AL049766, and AL121603.
HOVAI05	2235	932093	1 - 453	15 - 467	AA82882, and AA829114.
HOVAF07	2236	953553	1 - 151	15 - 165	AI252937, N74027, AA836182, AW338228, AI744524, AA910108, AA772555, AI027046, AI823533, F02523, AI823535, AW102980, AA745302, AI371165, AW002825, AA887470, AF001549, AP000502, AC004651, AC002996, U91318, AF134726, AF053356, AC000353, AL023575, AC004820, AP000113, AP000045, AC004985, AL031587, AC002073, AC005288, AC005821, AC002310, AC004967, AC005071, Z93930, AP000553, AC007041, AC004703, AC006014, AC004552, AL023801, AC005015, AL035249, AC005081, AC007371, AC007216, AP000299, AL136295, AL031230, AL034549, AC003689, AL109628, AC004834, AC007358, Z98941, AC005620, AC007955, AC007382, AC007191, AC005765, AC006241, AL020997, AL031283, U91326, AL031659, AC005789, AC002544, AC005837, AL122023, AC005874, AF134471, AC004814, AC003047, AC005823, AC005086, AC004883, AL049843, AL009181, AL022323, AL008715, Z98200, AC012330, S79836, U11297, AL049832, AL096791, AL033547, AC002477, AC004125, AL050317, AC004882, AL031846, AC002357, AC002549, Z94801, AC007325, AL035405, AC007981, L47234, AC005911, AC000075, U80017, AC007151, AC002400, AC008079, U78027, AC004531, AC004983, AC004217, AJ003147, AF045555, AC004837, AC004257, AC006101, AC004953, AC004966, AC005363, AL050325, AC005606, AC006088, AC020663, AC007688, Z81364, AL024507, AC004832, U95742, AL022476, Z92542, AC004583, AF039907, AP000208, AC006544, AC005225, AP000247, AC007229, AL109627, AC008132, AF030453, Z99943, AC002553, Z97183, and AL049748.
HOVAC77	2238	578783	1 - 353	15 - 367	R06198.
HOVACS4	2239	578809	1 - 499	15 - 513	AA180836, AA312397, AA477002, N64587, F03493, AA722297, AA550850, AI141130, AW246295, X56997, AC005253, AL133448, AC002477, AC003663, AJ003147, AC007308, AC006064, AL022320, AC007421, AL022323, AC005632, AC006480, AP000704, Z83840, AC005786, AL049779, Z85986, AC005520, AC005004, AI132712, Z98036, AC005274, AC007637, AC005089, AB023049, AC005231, AL049776, AC005180, AL133353, AC007676, AC009516, AC007298, AC006285, AC005940, AC005081, AL031295, AP000356, AC006211, AL021707, U63721, AC006101, AC004883, AC005048, AC020663, AC000134, AC012627.
HOVAC26	2240	578810	1 - 410	15 - 424	

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HOVAB85	2241	578788	1 - 394	15 - 408	AA938198, AL480041, and AA836516.
HOVAB61	2242	578791	1 - 672	15 - 686	AI912696, AA189100, AA449441, AI298393, N66646, AI281387, N66606, AA448930, T40424, T41267, N22111, AL096827, and AF086039.
HOOKF10	2243	961499	1 - 479	15 - 493	AI292005.
HOOKF04	2244	925784	1 - 577	15 - 591	AI807982, AI240099, AA868661, AA625993, AW269043, AI221135, AI024201, N33757, AI799092, and AF092091.
HOOU04	2245	925774	1 - 345	15 - 359	AI432402, AI276478, AI675712, and AA662663.
HOOUN04	2246	925783	1 - 541	15 - 555	AI206132, AI760658, AW207202, AI361331, AI309566, AL119748, AI436462, AL049085, F37471, AL042628, AL040243, AL035684, AB014511, AF152243, AL122049, and AC000403.
HOOUK11	2247	965292	1 - 472	15 - 486	AI333634, and H78014.
HOOUH05	2248	928627	1 - 238	15 - 252	AI223084, AA411815, and AA403084.
HOOUJ02	2249	917454	1 - 372	15 - 386	AI192015.
HOUIL05	2250	928644	1 - 430	15 - 444	AA470830, AI859849, AI766193, AW439625, AW439820, AI962973, AA464728, AI888957, AA463944, AA235454, AI933818, AA468183, AA844370, and AI127133.
HOOUIG03	2251	922510	1 - 423	15 - 437	AA088667.
HOOUH02	2252	917424	1 - 415	15 - 429	AW024908, AA678379, AA477631, N54347, and R26531.
HOOUH67	2253	969061	1 - 795	15 - 809	N95228, AW016802, AI375092, AI985579, AI188610, AI656562, AI972873, AI991588, AW055145, AI936408, AI292190, AI094172, AW182193, AI191047, AI078514, AI763004, AI830734, R38989, R49050, AA046092, H49273, AI202609, R99234, AI262420, H19327, AL037112, W87481, AA581541, N94137, AI221613, AA404487, W69271, AI521710, Z38912, R05523, H12506, AI468774, AA046135, AI984653, AW236116, AA099158, AA019723, AI554117, AI090954, AW007126, N70968, AL035700, AC007270, and AF131754.
HOOUHD06	2254	933873	1 - 235	15 - 249	AI560165, AI955723, AW138740, and AL133011.
HOOUAB23	2255	522227	1 - 542	15 - 556	AW292981, AA363225, AA363226, AI250281, AI912329, AI745457, AI815151, AI744548, AI760693, AA076391, H74235, AA491864, AA557604, AW301854, AA601230, AL079769, W60522, AI370264, AA501906, H63742, AC005544, AC005921, AF053356, AC016025.

					AC006285, AC005702, AB023048, AF165926, AC005280, AL035089, AC007262, AC004000, AL031848, AC005529, AC004150, AL132777, AL049874, AC005844, AC006354, AL031733, AC005212, AL009181, AC005071, Z95113, AC007540, AL109865, AC007993, AC005520, AC004099, AF109907, AC002470, AF030453, AC000085, AC006958, D84394, AC005881, AL033527, AL133163, AL021154, AF152364, AL109839, AF118808, AC005261, AC005015, AL135744, AC009516, AC004797, AC002350, Z95152, AC005004, AC004686, AC005200, Z92542, AL031666, AF196779, AC002117, AL133448, AC005193, AC004253, AP000512, Z85986, AC004858, AC006344, AC005081, U82828, AL022336, AC004458, AC004963, AC006203, AC005726, AC002544, AC004841, AL022328, AP000553, AC005191, AL049694, AC004491, AC007055, AC003070, AC007207, AC006547, AC004531, AC016027, AP000689, AC006160, AC016830, AL022316, AC005288, AC005067, AC004659, L78833, AC005488, AL049758, AF088219, AC003982, AC006111, AP000555, AC006057, AC005694, AL049539, AC005065, AC000025, AL050307, AL022238, AF190465, AL034379, AC004970, AP000155, AP000013, AC004675, AB001523, Z83840, Z98941, AF067844, AL020993, Z82215, AC010209, AF200465, Z83843, AC007011, AC006101, and AC004024.
HOOAB05	2256	932925	1 - 569	15 - 583	AI080164, and AA363261.
HONAK10	2257	968610	1 - 324	15 - 338	AA362963, AA281759, AW117976, AL135744, AF196969, AC006539, AC006077, AL049850, AC009516, AC004678, AP000553, AC005372, AC005411, AL049780, AP000114, and AP000046.
HONAH06	2258	936029	1 - 1105	- 15 - 1119	AA362851, AI499938, AW085790, AA488903, AL043009, AW069227, AA443390, AA569648, AW304580, AA281461, AA547979, AL041706, AI688846, AW022934, AW021161, AW193432, AI634187, F36273, AI510838, AI344844, AW269488, AI061334, T47138, AI049709, AI471481, AW193265, AI963720, AI560085, AL079869, AI287651, AL046409, AW438643, AI341664, AI350211, AI755214, AI369580, AI334443, AI279165, AI148277, AW162489, AW270270, AI619997, AA581903, AW338035, AA350859, AW338021, AI754567, AI375710, AA610491, AI457313, AI613280, AI754105, AI355206, AA493708, AL079645, AI587583, AL119691, AI587565, AW270716, AW148792, H73550, T74524, AI431303, AW276827, AA714453, AI635279, AA169194, AA348311, AA483606, AI291268, AI291124, AI380617, AI287451, AW419389, AI687343, AA631507, AA167792, AI801600, AI053672, AA570740, AI371070, AA758934, AI284640, AI270117, AI801591, AW327868, AI340453, AI761471, AA181773, AI801482, AA599920, AI589230, AL135377, AA491814, AI471572, AI744995, AI379719, AA177061, AI912322, AI635819, AI017024, AW022379, AI733856, AW023672, AL118991, AI583142, AA577906, AW245354, AA847499, AI537506, AI446259, AA719805, AW237905, AI860020, AI300054, AC005730, AC002377, AC007240, AC005180, AC004531, AL049588, AC008372, AC005486, AL049776, AC006285, AL031602, AC002404, AC009784, AC005274, AC004453, AC004019, AC006064, AP000049, AI035659, AC005620.

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HONAE50	2259	723571	1 - 545	15 - 559	W86672, and AA362593.
HONAD65	2260	747152	1 - 290	15 - 304	AA362745, and AA085323.
HONAD02	2261	859016	1 - 1041	15 - 1055	AA362710, AI873444, AA889371, AW376675, AI261617, AW376657, AW390112, AW376696, AI857990, AI431824, AI963829, AI632752, AI590245, AI953341, AW376640, AA888092, AF118395, and AF118855.
HOGEW23	2262	973221	1 - 595	15 - 609	AW392670, U46349, AL119355, AW363220, AW384394, AL119443, AW372827, AL119319, AL119497, U46345, U46350, AL119341, AL119457, AL119399, U46347, AL119391, U46351, and AL119497.

HOGDQ03	2263	922578	1 - 402	15 - 416	AL119324, U46346, Z99396, AL119484, AL119363, AL119444, U46341, AL119483, AL119335, AL134920, AL119439, AL119396, AL134902, AL119522, AL134527, AL042433, AL037205, AL119496, AL119418, AL039912, AL134538, AL119488, AB026436, AR054110, A81671, AR069079, AR060234, and AR066494.
HOGCW89	2264	973227	1 - 780	15 - 794	AA863353, D62887, AL119319, AL119355, AL119391, AW392670, AL119464, AL119324, AL119341, U46349, AL119457, AL119484, AW372827, Z99396, AW384394, AW363220, U46350, U46341, AL119497, AL119483, AL119363, U46347, U46351, AL119443, AL119444, AL119522, AL042984, AL119396, AL119439, U46346, AL134536, AL119335, AL037205, U46345, AL134902, AL119401, AL134538, AL042433, AL119401, AL134538, AL042433, AL119483, AL119341, AL119457, U46351, AW392670, AL119355, U46349, AL119319, AL119391, AL119483, AL119457, U46351, AL119324, AW372827, U46346, AW363220, U46350, Z99396, U46347, AW384394, AL119443, AL119484, AL119363, AL119391, AL119444, AL119497, AL119418, AL042984, U46341, AL119439, AL042433, AL037205, AL119335, AL134902, AL142131, AL119401, AL119522, AL134536, AL134538, U46345, AL119399, AL134525, AL119396, AL119496, AL119464, AR054110, AR060234, AB026436, AR066494, A81671, and AR069079.
HOGCT13	2265	657284	1 - 751	15 - 765	R54129, and R14999.
HOGCR31	2266	463874	1 - 592	15 - 606	R70301.
HOGCR10	2267	964761	1 - 687	15 - 701	N52836.
HOGCQ54	2268	859076	1 - 594	15 - 608	AA236968, AA761761, AA236930, AI823768, AI990131, AA195511, AW297141, AF139471, AP000547, and AP000365.
HOGCH05	2269	930813	1 - 663	15 - 677	N57691, H58749, and AF134882.
HOGCE07	2270	859077	1 - 531	15 - 545	R17461, and AA614012.
HOGCD61	2271	761991	1 - 465	15 - 479	R56752, F06590, AA338081, R15941, AA453210, T74962, R14640, F12752, AL117612, and AC009514.
HOGCC63	2272	745130	1 - 430	15 - 444	AA021008, and AA057308.
HOGCA65	2273	750308	1 - 547	15 - 561	T97004, AI076315, and T87200.
HOGB126	2274	847191	1 - 394	15 - 408	AA923566, AI754510, AI018234, W68384, AI376764, AI335263, AI769932, AI143581, AA456821, AI949857, W18181, AW305247, AI613113, W68500, H30442, AI190109, H11954, R44819, AA873841, AA767140, R16196, H30441, R16198, T16809, and H88480.
HOGBE27	2275	682232	1 - 281	15 - 295	AA025299.
HOGAM56	2276	908904	1 - 960	15 - 974	AI631040, and AA594778.
HOGA173	2277	764490	1 - 412	15 - 426	AA258075, AC007688, AC004878, AL133500, and AC006241.
HOGA126	2278	681919	1 - 497	15 - 511	H48638, W03175, and H58992.
HOGAH71	2279	760431	1 - 355	15 - 369	AA055623.
HOGAG57	2280	734848	1 - 621	15 - 635	AA737314, AA682280, AA010792, AA143573, AA953433, H23757, AA011221, AA745273, AA188649, and AF205935.

HOGAD77	2281	772319	1 - 563	15 - 577	R85394, AI078027, and R84629.
HOGAC69	2282	756713	1 - 694	15 - 708	AA594141, AI740524, AI419995, AA903241, AW069464, AI340359, AW194431, AI017580, AA858303, AI803720, AA074277, AL044093, AI921819, AI557117, AI190687, U69197, AI802592, AA889669, AI983007, AA207148, H11397, H96787, H16250, AI814813, AA427905, AI333376, AI268881, AI061243, AI963361, AA191622, AA846829, AI819766, AI190464, N51259, AA669068, AI150891, AA157806, AA135198, AA206434, AI925182, AI044094, AA135111, AW169049, AA034036, AI472734, AA135106, AW272442, N22707, AA609322, AA910279, AI262450, N71642, AI362641, N66837, AI138341, AA847184, N45294, T15527, AA907298, AI433939, AW263961, N67513, AA658226, T89105, AW183696, AA931425, AW105669, AA541311, AA160287, AA578579, AW069630, AW166420, AW021379, AI799396, AA610333, AI216722, AA620459, AA741223, AA704085, AI970644, AI864144, AA588415, F10050, T94064, AI277023, AA904093, AA747271, AA593048, AI160470, AW090441, AI445175, AI873497, Z41528, D20243, T10553, AA043331, T11277, AI383429, AI868926, AA886271, AA613110, AA043332, AW384062, AI687569, R23931, R00190, N31181, AI917566, AI123136, AI132258, AF061940, AF061938, AF061941, and AF061939. AW149722, AA452511, AA452655, AA359415, AI802674, AA341041, AA852853, AI149479, AW247428, AA359435, and AF104222.
HOFNW81	2283	789232	1 - 499	15 - 513	AI694574, AI299316, AI916308, AI809867, AI683372, AI650987, AI216772, AI700681, AI634004, AL042841, AI968717, AL042842, T67552, AA031777, AA778375, AI290605, AI806369, AI379501, AI433552, AI934582, AI635280, AI917817, AI968679, AW205433, AA640031, T94679, AW073063, AA400802, AI560612, T94326, AA736650, R44761, T55416, and C01874.
HOFNW69	2284	533713	1 - 658	15 - 672	
HOFNW68	2285	753048	1 - 142	15 - 156	
HOFNW65	2286	815822	1 - 417	15 - 431	D38026.
HOFNW45	2287	720755	1 - 104	15 - 118	
HOFNW07	2288	953436	1 - 397	15 - 411	
HOFNU50	2289	724437	1 - 465	15 - 479	W00809, H71229, AI688559, and AC005412.
HOFNL96	2290	888569	1 - 366	15 - 380	
HOFNI90	2291	788947	1 - 353	15 - 367	
HOFNI85	2292	784366	1 - 303	15 - 317	
HOFNI72	2293	760643	1 - 332	15 - 346	
HOFNI71	2294	760392	1 - 353	15 - 367	
HOFNI58	2295	859094	1 - 337	15 - 351	
HOFNI56	2296	859093	1 - 396	15 - 410	
HOFNI42	2297	713816	1 - 290	15 - 304	
HOFNI37	2298	859102	1 - 346	15 - 360	

HOFNI33	2299	859103	1 - 333	15 - 347	AW248328.
HOFNI32	2300	699299	1 - 364	15 - 378	
HOFNI10	2301	964682	1 - 305	15 - 319	D86969, AF127774, and Z83822.
HOFNI02	2302	917347	1 - 189	15 - 203	
HOFNC80	2303	835718	1 - 353	15 - 367	
HOFNC79	2304	774037	1 - 411	15 - 425	
HOFNB63	2305	613681	1 - 307	15 - 321	AI251832, AA622670, AA888154, AA994676, AA890531, AI141391, AI025322, AI587539, AA628616, AI338781, AW055053, AI147905, AA040767, AW272916, AI192845, AI338006, AI095692, AI144012, AI051360, AI205873, AA970491, AI374939, AI678799, AI869782, AI423147, AA973818, AI439825, AI520772, AW438950, AI694600, AI040992, AA935932, AA418706, AI091801, AI750219, AA425949, AI636432, AI079960, AA872649, AI061431, AA779735, AW275907, AA576868, H97795, W61292, AA814520, AW440409, AA812517, AI274100, AI128370, AA861315, AW169816, AA026344, NS0703, AW440389, AA147089, AI887699, H25461, AW270131, AI201428, AA099879, AI080203, AA173333, AA147095, Z21890, AW023278, AA780492, R52994, AI630374, AA173438, AW189739, AI890908, AA714013, R31084, H28954, AA037330, AA468886, T06660, AI217891, H07854, AA176908, Z41333, AI949085, D57501, AI351274, AA037329, AI864848, R34332, AA885673, AI079089, R80423, AA599378, AA464883, AI784205, R41882, AI864749, AI860102, T04889, T15425, AW189623, AA418715, AI982539, D53365, AW237884, T35361, AA284089, T25943, AA629755, W52902, H27251, AA489825, AI718058, AF000982, and U42386.
HOFNB55	2306	731801	1 - 54	15 - 68	
HOFNB51	2307	725684	1 - 419	15 - 433	
HOFMU70	2308	489858	1 - 142	15 - 156	
HOFMU67	2309	743184	1 - 1345	15 - 1359	AI394585, AI347406, AW300884, R60771, AI609950, N94357, AA768117, AA830837, AA778534, AI024114, AI340016, AI675916, AW027671, AW027648, AA983621, AI272784, AA918495, AA724472, AI335706, AI421130, AI340312, AI632085, AI159997, F35349, R49581, W52231, R36293, AL119324, AI431351, AL119399, AL119464, AI432666, AL119457, AI431346, AI432662, AI431243, AL042544, AI623302, AW392670, AI431354, AI431307, AI431316, AW372827, AL119443, AI432644, AI432649, AI431337, AI431312, AI432674, AL119355, AW128897, AI791349, U46351, AI432651, AI431230, Z99396, AI492509, U46350, AI432661, AL119319, AL134902, AI431238, U46349, AW081103, AI432675, AI431347, AI432653, AL119483, AI431328, AI432654, AI432655, AI431310, AW384394, AI432650, AI432677, AW363220, AL119497, AI432665, AL119484, AL119363, AL119391, AI431248, AI431330, U46347, AI432647, AI492519, U46341, AL119444, AL119401, AI432657, AL119341, AI431241, AI431345, AW128900, AL119418, AL042450, AI432643, AI431353, AI492510, AI431247, AL119439, AI431357, AL119522, AL119396, U46346, AL119335.

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HOFMU29	2310	824242	1 - 1023	15 - 1037		
HOFMT55	2311	888552	1 - 226	15 - 240		
HOFMT45	2312	891512	1 - 292	15 - 306		
HOFMS43	2313	947973	1 - 360	15 - 374		
HOFMS09	2314	972725	1 - 447	15 - 461		AW392670, U46347, AL043003, AL119439, AL119484, AW363220, AW384394, AL134132, AL119457, AL134530, AL134519, AL134531, AL134527, AL134528, AL043147, AL119522, U46351, AL119324, U46350, AL134536, Z99396, AL134533, AL134902, AL119497, AL119443, AL134153, AL119496, AL119396, AL119399, AL042989, AI142134, AB026436, and AR069079.
HOFMP09	2315	943358	1 - 545	15 - 559		
HOFMI25	2316	491360	1 - 412	15 - 426		HI6801, and AW080504.
HOFMF82	2317	693987	1 - 155	15 - 169		
HOFMF81	2318	788733	1 - 383	15 - 397		AA425224, N23786, N36074, AA779556, T66056, H29680, R60682, AW367327, T77025, H08571, F13183, Z43231, R19696, AI668657, AI734217, R54134, R18168, F12174, F08075, F07164, AA642020, F06393, AA314127, T33549, R12223, W20302, F07553, F05907, F05321, F05322, F05267, AF182814, and AJ243721.
HOFMF19	2319	888780	1 - 445	15 - 459		
HOFAF25	2320	942367	1 - 981	15 - 995		AA829001, AA837772, AC008154, and AC009275.
HOFAD78	2321	886485	1 - 689	15 - 703		Z99396, AL038837, AL037051, AL036725, AA631969, AL039074, AL036418, AL039085, AL036858, AL039564, AW384394, AL039156, AL038509, AL039108, AW392670, AL039109, AL039128, AW363220, AL036924, AL119497, AL037094, AL039440, AL039659, AL038531, AL036196, AL039625, AL039648, AL045337, AL038447, AL036767, AL037082, AW372827, AL037526, AL036190, AL037639, AL039678, AL039629, AL119443, AL039423, AL036238, AL039150, AL038520, AL040992, AL042909, AL119391, AL119319, AL037077, AL119457, AL119396, AL119324, U46341, AL119483, AL037726, U46347, AL119484, AL119363, AL119341, AL119335, AL119355, AL038851, U46350, AL119522, U46351, AL039410, U46349, AL119496, AL036998, AL037615, AL037085, AL036733, AL039386, AL036268, AL119418, AL119444, AL042450, U46346, AL119399, AL134533, AL037027, AL037178, AL042614, AL045353, AL037205, AL119439, AL036765, AL036679, AL042965, AL042975, AL134528, AL036973, AL119511, U46345, AL036191, AL042984, AL119488, AL134527.

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HODKG07	2322	951875	1 - 662	15 - 676		AA653929, F20611, and F20581.
HODJU05	2323	929321	1 - 471	15 - 485		AL135682, AA446265, T26578, H06982, C14389, C14331, D80195, D59502, D59619, D80210, D80240, C15076, D80164, D80212, D80022, D80166, D80219, D80193, D81030, C14429, D59467, D59275, D80227, D81026, D58283, D59859, D80391, D59787, D51799, D80253, D80045, D80043, AA305578, D80269, D80038, D80196, D50979, D80188, D59889, D59927, AA305409, D80248, D57483, D59610, D80378, D80366, D51022, D50995, D80024, AA514188, AW177440, AW360811, D80241, D51060, AW178893, D80133, D80522, D80251, D80132, AA514186, T03269, AW179328, C14014, C75259, D80302, AW377676, AW378532, AW375405, C05695, AW177501, AW177511, AW377671, D80268, AW178762, D80134, AW366296, D80439, AW360844, D51250, AW360817, AW375406, D58253, D80064, AW378534, AW179332, AW377672, AW179023, AW178905, AW178775, AW369651, D80168, F13647, D59373, AW352158, D59695, D80949, AW352117, A1910186, AW352171, AW176467, C14407, AW178906, AW352170, AW177731, D80247, AW178907, D52291, AW179019, AW179024, AW177505, C14298, AW179020, AW360841, AW178909, AW177456, AW352174, AW179329, AW178980, AW177733, AW378528, AW178908, AW178754, AW179018, C14227, D80157, T11417, D81111, D51103, AW179004, AW179012, A1905856, AW178914, AW378525, AW367967, D59503, AW177722, AW177728, D51759, AW179009, AW360834, AW178774, AW178911, AW378543, AW352163, D58246, C06015, AW378540, C14077, Z21582, D59627, D80258, AW178983, D59653, AW178781, T48593, D58101, C03092, AW352120, AW177723, AA285331, D51213, A1535850, D51097, D45260, C14975, AW378533, C14344, D80014, AA809122, AW367950, A1557751, A1525923, H67854, H67866, AW177508, T03116, AW178986, D45273, AW177497, D80228, D59317, A1535686, AW177734, A1525917, D59551, C14973, D51221, A1557774, D59474, A1525920, D60010, AA514184, D60214, A1525227, C13958, T02974, T03048, C14957, C14046, A1525925, A1525242, A1525235, D51053, A1525912, AW378542, F13796, A1525215, AW378539, C16955, C05763, A1535961, Z33452, A1525237, A1525222, AC007686, A84916, A132110, A62300, A62298, AR018138, AF058696, AR008278, AB028859, X67155, Y17188, D26022, A25909, A67220, D89785, A78862, D34614, Y12724, I82448, D88547, A82595, X82626, AR060385, AB002449, A94995, AR016808, AR025207, AR008443, I50126, I50132, I50128, I50133, AR066488, AR016514, A45456, AR060138, I14842, A26615, AR052274, AB012117, AR066490, Y09669, A43192, A43190, AR038669, AR066487, I18367, A30438, X68127, AR054175, D50010, Y17187, A85396, D88507, AR066482, A44171, A63261, A85477, I19525,

						A86792, AR008277, AR008281, X93549, AR008408, AR062872, A70867, AR016691, AR016690, U46128, D13509, I79511, A64136, A68321, AR060133, U79457, AF123263, AR032065, X72378, and AR008382.
HODJL04	2324	926200	1 - 314	15 - 328		AA649610, AA761836, and Z97195.
HODHK07	2325	952193	1 - 521	15 - 535		H03808.
HODHG11	2326	966063	1 - 704	15 - 718		AI208573.
HODGL88	2327	859300	1 - 655	15 - 669		W78906, N87704, R01599, and AF131819.
HODGJ02	2328	918476	1 - 466	15 - 480		N77172, AA247874, and AC004492.
HODFY10	2329	963350	1 - 461	15 - 475		AA426476, and AA424622.
HODFX19	2330	842138	1 - 733	15 - 747		AI376921, AA975777, A1001802, AI986107, AI277187, AA024836, AA814148, AA946575, AI823500, AI934527, R01773, AA069448, AI214374, AI261766, AI740547, AI149941, R67552, AI761204, H22357, AA991800, AI394623, AI090982, T50900, AA634859, AA931388, and AF055496.
HODFX12	2331	969588	1 - 320	15 - 334		AI936005.
HODFX04	2332	926278	1 - 479	15 - 493		AA976439, and N77643.
HODFW95	2333	795281	1 - 798	15 - 812		W93859, W93898, AA829836, and AF086497.
HODFW40	2334	859320	1 - 542	15 - 556		AA972774, and AI694547.
HODFR85	2335	783789	1 - 489	15 - 503		N76385, AA954669, N71863, AI041474, and AI937830.
HODFL37	2336	948703	1 - 450	15 - 464		
HODFJ11	2337	966065	1 - 476	15 - 490		AA242986, and AA242787.
HODFI66	2338	974317	1 - 523	15 - 537		
HODFH45	2339	974916	1 - 606	15 - 620		AL121595.
HODFG82	2340	779191	1 - 544	15 - 558		AI733904, and AA160258.
HODFF88	2341	974911	1 - 1843	15 - 1857		D80164, D59502, D80193, D80195, D59275, C15076, D80227, D58283, D80022, D80166, D81030, D59859, D51799, D59619, D80210, D80391, D80240, D59787, D51423, D80253, D80043, D80269, D50979, D80212, D80038, D80196, D80024, D80219, D80188, C14331, D59467, D57483, D59927, D80378, D80366, C14389, D59889, D50995, D80045, D59610, AA305409, C14429, D80241, D51060, T03269, C14014, AW178893, C75259, AA305578, D81026, D59695, D51022, AW179328, D81111, AW178775, D80134, AW378532, AW177440, D51250, AW352158, D80268, F13647, AA514188, AW369651, D80251, D80522, D51079, D80248, D80949, D58253, AW178762, D80168, D52291, C14227, AA514186, AI905856, AW177501, AW177511, D80133, Z21582, AW360811, C05695, C14298, AW352117, D80064, AW176467, AW375405, AW378540, C14407, AW377671, D51097, AW366296, D80302, AW360844, AW360817, AW375406, AW378534, AW179332, AW377672, AW179023, AW178905, D80132, AW360834, AA285331, D80439, AW352171, AW377676, AW178906, AW352170, AW177731, D80247, AW178907, AW179019, AW179024, D51103, AW177505,

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HODFE04	2342	926999	1 - 429	15 - 443	R83400.
HODFD73	2343	909812	1 - 603	15 - 617	AL050332, AF050183, AF058790, AF058789, AF048976, and AB016962.
HODFC79	2344	774156	1 - 415	15 - 429	W93152, and AW272240.
HODEZ45	2345	974337	1 - 516	15 - 530	
HODEU01	2346	915167	1 - 508	15 - 522	R93800, T77247, and R08385.
HODET07	2347	952194	1 - 410	15 - 424	H80608.
HODES10	2348	963474	1 - 186	15 - 200	AA076702, and AC004928.
HODEO35	2349	859364	1 - 124	15 - 138	AA595928, AA461421, and AP000553.
HODEK82	2350	779245	1 - 673	15 - 687	AI660692, H96927, and AI471598.
HODEA14	2351	859375	1 - 664	15 - 678	N44316, L44479, AW016606, AA524565, AI809352, and AC004821.
HODDX64	2352	745810	1 - 460	15 - 474	N71060, T99547, AC001228, U51281, and Z97056.
HODDS89	2353	531075	1 - 476	15 - 490	N52086, and AA927904.
HODDS74	2354	765863	1 - 221	15 - 235	T77437, and AW292096.
HODDF37	2355	420051	1 - 536	15 - 550	AC002559.
HODDE02	2356	920961	1 - 419	15 - 433	AI378347, AI082130, and AA563785.
HODCZ64	2357	745966	1 - 391	15 - 405	C14014, D80253, D51060, D80366, AA305409, D80439, AA514186, D80166, D59619, D80210,

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HODCZ39	2358	875811	1 - 410	15 - 424	W04443, AA132310, R78009, and AC012627.
HODCY73	2359	764543	1 - 447	15 - 461	A1816780, A1458427, A1828772, AA970754, T90292, AA723211, C15270, R55335, A1700847, A1800369, F04197, AA172179, R48809, AA634235, H26791, AW137473, R48921, A1056206, and AL021920.
HODCY32	2360	859543	1 - 514	15 - 528	

HODCW83	2361	781287	1 - 194	15 - 208	AI570526, W35195, AA425012, AI190032, AI949009, AW236490, AI632129, and AI695985.
HODCV61	2362	868291	1 - 760	15 - 774	
HODCO15	2363	660502	1 - 608	15 - 622	W00867, AL045871, AL046306, AB014529, and AF176555.
HODCJ84	2364	973286	1 - 680	15 - 694	
HODCC05	2365	932633	1 - 772	15 - 786	AA773910, W28027, AP000549, and AC006946.
HODCA90	2366	792611	1 - 356	15 - 370	AA005005.
HODBZ85	2367	784526	1 - 370	15 - 384	H70407.
HODBX08	2368	960178	1 - 617	15 - 631	W87564, and AA837795.
HODBU72	2369	766284	1 - 336	15 - 350	AA503323, H89112, H89218, and AF086031.
HODBK84	2370	859558	1 - 614	15 - 628	AA682892, AC002116, AC007537, AC006071, AL031432, AL021366, AL050332, AC004921, AC004841, Z93016, AC002477, AC006960, and AC005480.
HODBF61	2371	742114	1 - 240	15 - 254	
HODBF40	2372	529387	1 - 325	15 - 339	AF179633.
HODBF33	2373	702750	1 - 179	15 - 193	N78634, AI655262, AI219603, AI337066, AW016620, AW299342, AA806525, AI343418, and AA314128.
HODBF17	2374	529389	1 - 338	15 - 352	AW297233.
HODBD93	2375	792579	1 - 510	15 - 524	AA150484, AA156687, AI915919, T24517, and AL122023.
HODBD73	2376	764670	1 - 503	15 - 517	R95802.
HODBC42	2377	529635	1 - 560	15 - 574	AA031438, AA031560, AI335617, and AC004067.
HODBA48	2378	721931	1 - 662	15 - 676	N35773, AA020962, AA429989, AA019518, and AC005046.
HODAZ21	2379	826693	1 - 606	15 - 620	D80195, D80022, D80043, D58283, D80302, D80038, D50979, C14389, D59467, D80164, D59275, D80253, D80227, D59502, D50995, AA305578, D51423, D80247, D80522, D80439, D80188, D81026, D80269, C14014, D80366, D59859, C14331, D80166, D59619, D80210, D51799, D80391, D80240, D59610, D59787, AA305409, D51022, C15076, D81030, D80248, D80212, D80268, D80193, D80196, D80045, D80219, AA514188, D59927, D80024, D57483, D80378, D51060, D51103, D59889, D80133, AA809122, D80241, AA514186, D80157, D80251, AW360811, AW177440, D51759, C06015, C14429, AW178893, T03269, D45260, AW377671, AW375405, C75259, AW178906, H67854, D59653, AW366296, AW360844, AW360817, AW179328, T48593, AW375406, AW378534, AW179332, C05695, AW377672, AW179023, AW178905, AW177731, AW378528, AW178762, AW179019, D59373, AW378532, AW177501, AW177511, AW179020, AW352171, AW377676, H67866, AW352170, T11417, C03092, AW178907, AW178908, AW179024, T03116, AI525923, AW176467, D51250, D59317, F13647, AW360841, AW360834, AW352120, AW177505, D52291, AW178775, AW367950, AW178909, AW177456, AW179004, AW179329, AW178980, AW178986, AW178914, AW178774, D80258, AW177733, AW178754, AW179018, AW352158, D59503, C14973, AW352117, D58246, D81111, AI525917, D80014, D60214, C14227, D80064, C14344,

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HODAX45	2380	723449	1 - 384			15 - 398	R07196, and N59556.
HODAV84	2381	592179	1 - 623			15 - 637	
HODAV24	2382	679165	1 - 392			15 - 406	
HODAK55	2383	745532	1 - 411			15 - 425	H60974, R07912, N22871, and H84048.
							R83642, T81960, AW068239, H60497, N44274, AA318156, H10590, AW404818, AA642219, AA773468, N72512, W85743, AA009995, T92075, R12889, AA853594, W21986, A1686932, AW024419, AA743833, AA627696, AW162688, AW003662, AA326440, AW088539, R21041, AA053566, A1955325, AW364257, A1565761, AA337700, A1827029, AL137377, AF100752, AC004472, M30143, Z14044, and AF122048.
HODAK05	2384	932639	1 - 453			15 - 467	AA132943.
HODAE72	2385	529638	1 - 122			15 - 136	
HODAE55	2386	529637	1 - 163			15 - 177	
HODAE48	2387	529639	1 - 116			15 - 130	D61881.
HODAE01	2388	921680	1 - 306			15 - 320	H69836.
HODAA92	2389	790588	1 - 239			15 - 253	
HODAA85	2390	784534	1 - 173			15 - 187	
HODAA80	2391	529560	1 - 284			15 - 298	
HODAA69	2392	529563	1 - 334			15 - 348	AC007030.
HODAA54	2393	859582	1 - 237			15 - 251	
HODAA34	2394	529570	1 - 300			15 - 314	AL034553.
HODAA21	2395	859583	1 - 502			15 - 516	T48184, and AL035530.
HODAA15	2396	523382	1 - 119			15 - 133	AL022068.
HODAA07	2397	954157	1 - 106			15 - 120	
HODAA04	2398	927711	1 - 291			15 - 305	
HOCPU05	2399	928651	1 - 753			15 - 767	AI189844, AI201116, AA609456, AA584808, AA780934, AI219194, and AL022271.
HOCPH02	2400	917453	1 - 468			15 - 482	AI610771, AI469844, N40199, AA588746, T70544, N39125, AI937318, AI500487, R37094, R16096, AI748890, and AA258667.
							AA280263, AA403050, and AL050343.
HOCPF02	2401	917630	1 - 820			15 - 834	AA766710, AA767401, AA804400, AI860423, AI753904, AI434653, N66775, AA555232, AI357762, W45274, AA084504, AW249660, AI521525, AA846923, AI571863, AW249541, AW020150, AI926102, AA324559, AA326603, AA632024, AA324059, AW084445, AA773098, AI537368, AW008217, AA582622, AC016025, AC005071, AC005902, AC004820, AC005696, AC005919, AL022327, AC005971, Z82244, AI.121652, AC007227, AP000240, AC005089.
HOCOV07	2402	951744	1 - 557			15 - 571	

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HOCMM01	2403	914464	1 - 814	15 - 828	AI348389, AA631606, and AL031297.
HOCMI24	2404	878363	1 - 512	15 - 526	AA088637, and AW298364.
HOCMC01	2405	914552	1 - 444	15 - 458	AA699519.
HNOJ112	2406	969077	1 - 1757	15 - 1771	AW295026, AI276473, AI553987, H08317, AI955362, H50857, W38821, T75180, R56504, T70815, F12882, R19236, T78969, R20397, T98878, R19579, AI312653, H95935, AA090801, AA361971, AA479557, R92663, AA454914, AI659055, AI480397, AI524497, AI440293, AA788769, AI589107, AA630007, AI380567, AA564726, AI262311, AW027577, AI766536, AI332995, AA044714, AA100613, AI471849, AI674449, AI190957, AI632486, AI891104, AI298730, T77169, R45788, H22006, T86237, R80609, T83221, H20293, AI690130, AA368757, AW179044, W73553, N80081, AA730555, AI338393, and D25218.
HNOAD04	2407	926258	1 - 745	15 - 759	AA814415, AI378392, N45120, AI457108, AA809495, AA835661, AA831169, AI351546, R43018, R44581, AI824326, and AW136327.

HNNNB08	2408	957719	1 - 346	15 - 360	<p> AI467919, AI091495, AI219406, R66014, H12334, R71247, R26409, C18360, C18357, H53522, H02244, R78907, AA368929, R67934, R77608, R38313, R34846, R62787, R10842, R67128, R65605, AI937850, AL046409, AW303196, AW274349, R24497, AI471481, AW301350, AI613280, AW193432, AI375710, AI350211, AI341664, AI537955, AW193265, AI688846, AI345654, W79504, AI365988, AI291268, AI291124, F29989, AI334443, AA350859, AI053672, AW438643, AW406755, AI653886, AW419262, AI499938, AA649642, AI608771, AA133986, AI357551, AI281881, AW338086, AA594145, R24492, AL041690, AI358229, AW406162, R27623, AA719805, T07451, N25296, AA134367, R71050, AI198376, AI475569, AI340453, AI344844, AA654771, AI963720, AA551503, AA613345, T06828, AA599129, AW302013, AI061334, AA581903, AI635818, AI270117, AW079135, F19012, R62788, AA720758, AI284640, AW339687, AI379719, AA533725, AI744995, AW276827, AA630925, AA630030, AI133164, F18974, AW265009, AI262909, AA599920, AA714453, AA664015, AI583594, AI754955, AI801600, F36306, AA179136, AW338500, F03525, AI887483, AA491814, AI357288, AI888008, AI537030, AI564185, AI283911, AI289067, AI044940, AI568678, AI801591, AA577906, AA720702, AI364809, AI708009, AA825357, AI002834, AA074130, AL119691, AL042420, AA352803, AF150152, AW117750, M86143, AA525824, AI246119, AA603445, AA280632, R77905, AA486414, AI889923, AA446657, AA649705, AA970213, AA259245, AA973803, AA368936, AA621858, AI431303, AW088718, AI358343, AI049634, R98967, AI635272, AI370074, AI370094, AA861959, AA713815, AI370057, AW265385, AI471572, T29180, AA678436, AA364429, AL079812, AA513293, AA573020, R97934, AI446464, AI313166, AA810318, AA491762, AA579063, AI827234, AI917156, AI053790, AW338419, AI921188, AI697369, AA346458, AI370878, AI589230, AA629415, AA113376, AI871722, AA639248, AL135405, AA437161, AA664535, AA126777, AA829223, AI888518, AI434695, AW339568, AA641103, AA559290, AI963095, AI471543, AI754658, AI761471, AA623002, AA225072, AW088058, AL048925, AW103981, AI339440, AA621704, AA602528, AW303876, AC005281, AF077058, D83989, X53550, X75335, AF015157, M87919, U18391, U57005, U18392, X55925, U18390, U18394, X54175, X54180, U57006, U18393, X55930, I51997, S77605, U18395, X55926, U57009, U57008, X55932, X54178, U18398, U18387, X54181, U18399, X54176, X55931, S70707, U67801, AF015151, X54179, AF015153, AP000297, AL031668, X60459, AL078581, U18396, U57007, AF015147, X76629, AF015154, AL023882, AF015149, U67827, M37551, AP000044, AP000112, AF015155, U80017, U18400, AL117330, Z22650, Z84487, AC005914, AC004814, AC002350, AL121577, AC005535, AC005245, U66059, U78027, X55927, U57004, AF060568, AF161343, L47228, Z98258, AC004799, U73649, AL049692, AC008163, AC005815, AC004087, AL049745, AC004975, AC004915, AC007278, X53548, U67231, X55928, AL035665, AF123462, AC005907, AC004686, AL031777, X54177, X55924, AC005808, AC004841, AL035361, AL049759, </p>
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HNIAB92	2410	683077	1 - 199	15 - 213	

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HNIB73	2411	764172	1 - 536	15 - 550		
HNIB26	2412	974750	1 - 374	15 - 388		
						A124125, A1497916, A1807817, AA287075, AA410717, W69383, W69382, A1167280, H75982, D31247, AA428123, F06544, T78145, AA419308, AA404625, N41831, AA339686, N56216, D31349, AA284532, A1672472, A1366704, AW130807, A1590376, A1274769, A1370149, and A1357616.
HNBVH02	2413	917719	1 - 272	15 - 286		A1128931, N59410, H71850, H68617, AW026005, H72896, R89336, R89422, A1890794, AL120188, AL117354, Y10196, and AC005535.
HNBVC03	2414	922402	1 - 384	15 - 398		AA455727.
HNBUC06	2415	933673	1 - 633	15 - 647		A1003929, A1203393, A1434650, A1741385, A1239480, AA931467, A1819627, AW183189, F31423, F35609, AA905778, F21790, and AW105048.
HNBUC01	2416	914361	1 - 520	15 - 534		AA501715.
HNBUI10	2417	961734	1 - 483	15 - 497		AA954976, A1017449, T89711, W69257, A1150048, AA534436, T89631, A1261657, AW166311, A1627633, AA947856, W69170, A1831660, A1473887, AA909065, A1140835, AA862617, AW449791, AW445047, T89808, and A1795971.
HLWFF69	2418	754476	1 - 398	15 - 412		R76168, and R39664.
HLWFB01	2419	915399	1 - 481	15 - 495		AW451092, A1653216, AA825520, AA828034, AW449785, AA766435, A1379959, AA811081, AA626324, AA251105, A1281315, A1281259, AA252357, A1857494, AA767770, AA961612, AA884914, A1910531, AA883131, and AL117637.
						N27780, H55265, AC004527, and AL078614.
HLWEH10	2420	963548	1 - 600	15 - 614		AA397990, W65316, and AC010582.
HLWEA90	2421	787632	1 - 438	15 - 452		AA758158, AA143536, AA311020, AW403447, W63569, AA004530, AA683390, N29003, AA209228, H28875, AA305513, AL120940, W77945, AA582670, AA297602, C18645, AW402233, R23541, AA132404, A1752266, AA115891, T19100, AA442767, A1768639, AW183765, A1816897, W38538, A1829074, R19741, T34258, H12133, W44478, F12975, R61604, N34198, A1769388, T34524, AL121186, Z30133, T31614, H06006, T34085, AW188331, AA429756, R80093, T28136, T75286, A1767235, AA126374, T34569, T34148, A1908731, AA864619, F07189, H12905, N33792, T85612, A1685398, T31638, H62867, N69429, N20135, H62527, AA352184, H82866, H09563, T31635, A1224550, AW363446, AA704311, H96883, R10946, N84652, T52635, W56201, D82488, D82543, R26017, A1274027, D82466, R10524, N36374, A1283942, D82428, AA962407, N90094, AA380459, W32740, N36598, A1224548, C06105, A1739339, AA132405, W27707, AA375383, F07315, F05953, AA310081, T78753, AA004531, F05952, A1023176, A1299400, R85616, W20495, H84839, T25453, N83818, T27432, AA054436, T25450, H63569, R53662, AW381573, AA694564, AA130964,
HLWDZ31	2422	917643	1 - 880	15 - 894		

HLWDD01	2423	915378	1 - 419	15 - 433	AL008725, AF107406, D17446, and S83440. AI266250, AW069227, AI634187, AI457313, R83014, AA610255, R16565, R48980, AI254508, AI251696, AA715508, AA601673, AW090629, AL031296, AC004851, AC004031, AF207550, AL021367, AB022785, AP000065, AL110502, AF165926, AC005280, AC005253, AL009181, AC005828, AL049780, AC004531, U52112, AC005081, AC004890, AL031281, Z97054, AL133246, AC002314, AC006537, AC005940, AD000671, AC008124, AP000553, AF157814, AC004771, AL096791, AL020997, Z95115, AC005324, AC005669, AF134726, AC005209, AB026898, AC006965, M89651, AC004812, AC005291, AP000557, AL031255, AC005146, AC005071, AL109798, AC006241, AC006146, AC002477, AC005702, U80017, AC006449, AJ006216, U73629, AC009516, AC007386, AC004770, AF001549, AL022322, AP000509, D84394, AC005785, Z98044, U07563, AC007283, AC005067, AC007227, AC005231, AL035458, AC002472, AC005342, AC007676, AB017602, AC007055, L78810, AC006539, AC005086, AC006946, AP000694, AC000025, AC008545, Z95331, AC002115, AC007934, AL034420, AC006530, and AL035659. N42593, AA376825, AW104181, AI215001, N83895, AA374608, AW293450, AB020685, and M77174.
HLWDB48	2424	856512	1 - 670	15 - 684	AA053452, T07266, and AB020631.
HLWCP60	2425	739801	1 - 419	15 - 433	R11514, R10440, R97177, A1890794, AL117694, U07563, L47334, AC005023, D83253, AL109802, Z84484, AP000009, AF001549, AC002978, Z84480, AC008989, Z93930, Z98742, AC005071, AC007993, AL031319, U89337, Z98044, AC002070, U91318, AF001552, AC007030, AC003046, AP000299, AL121657, AF039907, AC007450, AF190465, AC005722, AC005602, AL035410, AB000882, AC004750, AC006581, AC003009, AP000229, AP000113, AP000045, AC006543, AL035073, AC003683, AC002400, AC006312, AC008372, AC005409, Z82206, AC007227, AP000555, AC016025, AF053356, AL109967, AC006450, U63721, AC004953, AC005792, AC007773, AC004751, AP000502, AL009181, AP000689, AC006544, L48038, AC004878, AC006030, Z93244, AC004832, AP000696, AB003151, AC003101, AL035587, AL023284, AC004967, AF030453, and AC005231.
HLWCN50	2427	723787	1 - 416	15 - 430	N47899, H53415, and AL049742.
HLWCF83	2428	781069	1 - 660	15 - 674	W33061, R98276, and AC004022.
HLWCF33	2429	687995	1 - 489	15 - 503	AA121582, AW368442, AA188145, AB011132, and U90333.
HLWCE47	2430	720156	1 - 599	15 - 613	AI207452, AI936201, and AA005229.
HLWCB93	2431	623773	1 - 546	15 - 560	AW082490, AW157667, AI032875, AC005899, AC005231, AL109623, AC006449, AL049539, AL049779, Z98941, AC006312, AC004383, AC004491, AJ003147, AC007157, AL139054, AC006285, AC006450, AL031276, AC005792, AC005015, AC005086, AF196779, AC002470, AC002287, AC004913, AC004876, AL034549, AL133355, AL035587, AP001054, AL035413,

HLWBX42	2432	917920	1 - 445	15 - 459	AL109827, AC007546, AL049780, Z98200, AL109984, AC007151, AC005081, AC004813, Z85986, Z84469, AC007308, U91323, AC005902, Z84487, AL049709, AC007055, AL022336, AL031281, AF024533, AC005412, AC005585, and AC005484.
HLWBW29	2433	690515	1 - 375	15 - 389	AA427651, AI143307, AW262122, AA703186, AI659343, AI341865, AI336119, AW237136, AI298482, AI090247, AI333715, AI803140, AA579615, AI056488, AA779669, AA620404, AI089588, AI278727, AW090136, AI811913, AA427568, AI911844, H91654, AI610128, AW129695, AA593874, AI870923, AA651783, AA112592, AA058719, AI400566, AA506145, AA622437, AA478461, AA862138, AI784558, AI589813, AW007077, AW169327, AI377030, AW438992, AW328677, AA112591, and AC005606.
HLWBT09	2434	887877	1 - 405	15 - 419	H71264.
HLWBS62	2435	743406	1 - 627	15 - 641	AA214571, AI341246, AI686298, AI652114, W72303, AW391831, AW445137, AI672184, AI872269, AA805368, AA765438, AI865260, AI867970, AI364061, AA653004, AA283893, Z41015, AI652648, T82714, AW274161, AI964056, AC005203, and AC006111.
HLWBR85	2436	784261	1 - 431	15 - 445	AI984203, W67492, AA883778, W67493, and AF086252.
HLWBQ91	2437	790072	1 - 449	15 - 463	N91340, AF174590, AF199355, AF176699, and AL022395.
HLWBJ65	2438	747784	1 - 526	15 - 540	AA424081, and AL049611.
HLWBH92	2439	791355	1 - 443	15 - 457	AA457580, and R79039.
HLWBG78	2440	888068	1 - 395	15 - 409	T89902, H30889, H22380, and H43169.
HLWBF48	2441	721530	1 - 367	15 - 381	AI016222, R14088, AW189819, and Z73965.
HLWBE74	2442	887967	1 - 336	15 - 350	
HLWBC21	2443	869611	1 - 850	15 - 864	AI625008, W81042, AI161322, AI913667, AI284153, AA194209, AI654706, N51502, AA194051, AW205155, AI739408, AI380903, AA025476, AW392596, AW385770, AI240820, AW135136, AI697491, AW204701, AA680407, AA478609, AI916011, AI242934, AI497867, AA341635, AA025395, AA693802, AA521100, AI392857, and AC002400.
HLWBA80	2444	720397	1 - 484	15 - 498	N41645, AW293280, AA287310, D86324, AF074480, AF074481, AB013814, Y15010, and D21826.
HLWBA27	2445	931387	1 - 614	15 - 628	W88551, AW404842, AA292392, N41305, AA292935, N41626, AA491168, AA444087, H01356, R76165, AA001523, W45105, N28012, N42038, AA084557, AA296707, AW402649, AA069991, AA293237, AA428716, H80482, AA551614, AA297430, AA298686, AA128142, R75992, R77570, H68568, AA627682, AA405634, R89661, H28321, R78029, AI908992, N45084, H4883, AA298929, AA151090, AA055024, AA122427, AA296825, H91109, AA315750, R83924, AI218665, H72458, R08383, AA132173, AA027794, AA046903, AA077970, AA296925, W02601, AA297915, AA297486, AA297626, AI582212, AW170331, AA297026, H50802, N33748, AA297426, H24598, AA297282, AA296904, AA419378, AA296946, and AF070657.

HLWAW86	2446	785395	1 - 522	15 - 536	AA460460, AA969196, and AA885014.
HLWAS09	2447	625419	1 - 223	15 - 237	AA602628, AA352444, AA363279, AC005969, AC004087, AL035414, AC006511, AL109627, AC004167, AL034430, AL133246, AC002543, L78833, AB022785, AC007055, AL049692, AP000032, AC005971, AP000065, AC005747, AC005726, and AL031311.
HLWAR08	2448	959139	1 - 378	15 - 392	AA078617, AJ133128, and AF160798.
HLWAO67	2449	751503	1 - 509	15 - 523	H82640.
HLWAL31	2450	948928	1 - 110	15 - 124	
HLWAI18	2451	666281	1 - 634	15 - 648	H15126, AB006621, and AF043644.
HLWAF02	2452	919714	1 - 1216	15 - 1230	AW003851, AW088297, AI004165, AW269624, AW073468, AA577265, W72446, AI863050, AI421770, AA421538, AI075847, AA700334, AA417216, AI240802, AI190446, AA780709, AA483528, AI569614, N94131, AA810760, R12682, W76345, AA814987, AI358895, AA872030, AA730737, N98502, AI690632, AI680891, R43271, N69310, R94006, W31068, AA864933, N58801, F10192, R16421, H99624, AI469697, AI017646, AI370275, AL036104, R93962, AA295338, AA357137, T52302, T52379, Z41369, F09802, H26767, AI370655, AA411262, AA318970, W74385, AI094731, AA411187, AF004539, AI344163, AI609867, AI308040, AI311256, AI271279, AI224267, AW384040, AW274178, AA741082, H26877, AW302337, AI284896, T65221, and R06090.
HLWAE09	2453	789030	1 - 451	15 - 465	R20247, AI200505, AW004679, AA157883, AA314101, F36978, AA225574, AW305024, F31978, AW005776, AW337620, AW028286, AI022592, AI039214, AI797665, AW080293, N53067, AA131444, AA126253, AA724826, AA428376, AA418101, AW197423, AA865238, H10347, AA618216, AA069136, AA437116, C16904, F22050, AA147181, AA393974, AI970244, T11676, H56645, R58957, AA069174, N62528, AI908026, AW303992, AA069297, H15057, AA031896, AA552427, and AL050260.
HLWAD57	2454	734655	1 - 450	15 - 464	AA213840, AI348503, AI680719, AA401344, AI868950, AI565065, AW058511, AI476408, AI298543, AI680824, AW207207, AA970373, AI084988, N74713, N22538, AL049651, AL133371, AL079352, Z83745, AC002416, AC006928, AL033539, and Z83848.
HLWAD33	2455	702317	1 - 454	15 - 468	AI220952, R21518, AC004675, and AF088219.
HLWAD32	2456	699158	1 - 289	15 - 303	
HLWAD02	2457	919725	1 - 529	15 - 543	AI500547, and AW276592.
HKZAH11	2458	965175	1 - 809	15 - 823	AI653262, AI637996, AI538731, AA808027, AL036361, AI536685, AI811344, AW087445, AA470491, AI499381, AI866090, AI608936, AI475371, AI270183, AI491852, AW088793, AI590415, AL079963, AW132056, AI284084, AI612913, AI537677, AW081036, AW102785, AL134259, AI818980, AW235482, AI802542, AL042745, AI635461, AL042382, AW051258, AI453322, AI271786, AW082113, AI637584, AI819976, AI698391, AI281773, AW150578, AI524671, AI926367, AI280637, AI559296, AI862139, AI491775, AI280747, AI890833, AI926790, AI564719, AI863241, AI932794, AI611738, AI955917, AI619502, AI677796,

AW129659, AW026882, AW104724, AI610402, AI433157, AI702073, AI978703, AI619607, AW192687, AI633125, AI922365, AI121365, AI570989, AI697321, AI521560, AI890223, AW080746, AI929108, AI620003, AI439762, AI769205, AI889376, AW081797, AI632408, AI499285, AI815855, AI648509, AI254731, AI119863, AI866457, AI036403, AW129916, AI872545, AI571909, AI045500, AI569583, AI798456, AI404448, AI624206, AI696612, AI922901, AI274508, AI934259, AI921248, AI570807, AI431975, AI783792, AW198090, N33175, AI799183, AI285735, AI287326, AI538085, AI567769, AI889189, AW071349, AI318280, AI636456, AI815232, AI536638, AW151485, AI452876, AW262565, AI634751, AI439256, AW075381, AI609331, AI042744, AI468872, AW104827, AI445025, AA225339, AI679174, AW074172, AI036780, AI355827, AI627988, AI648663, AW150453, AI670009, AI432969, AW118518, AW073865, AI174394, AA806720, AI871697, AI042628, AW074161, AI923370, AI281772, AI590227, AI039086, AI036901, AW020561, AI036736, AI816010, AI874261, AI036265, AI440239, AI285448, AI865931, AI538259, AI654276, AI269862, AI933589, AI491897, AW080090, AI625079, AI047763, AW148363, AI684234, AW192652, AI434468, AW160376, AI044207, AI873644, AI249800, AW190042, AI640873, AI445432, AI521040, AI499463, AI859511, AI630928, AI571439, AI631107, AI636588, AW080327, AI922676, AI567993, AI687728, AW088903, AW076093, AI043975, AI567128, AW162071, AI801460, AI591420, AI539771, AI500523, AI686817, AI048871, AI306613, AI247293, AI040241, AI537273, AW118496, AI819326, AW075667, AW166903, AI634737, AI539780, AI697137, AI591075, AW148408, AI045266, AI572021, AI682798, AI634345, AI818683, AI435641, AW117746, AI812015, AI610690, AI921379, AI537024, AW169671, AI801152, AI796743, AI476046, AI886753, AI687127, AI828682, AI610307, AI687362, AI620284, AI252023, AI918435, AW050850, AW193530, AI609589, AW073270, AI457369, AI286256, AI284517, AI431327, AI358107, AI538116, AI247193, AW166583, AI567940, AI923124, AI682971, AI469532, AI77401, I48979, I89947, I48978, AI133560, AI050277, AF113019, A65341, AF113694, AF111851, AI122050, AI122110, AI117435, AI137459, Z82022, A77033, A77035, AF090903, S68736, A08913, AI137557, AI137550, AI122121, A08916, AI137271, AF146568, AF090900, A08910, Y11587, AI110221, AF158248, E07108, AI117457, A58524, A58523, I89931, AI050149, AF090901, I49625, AF183393, AI122098, AI050393, AR011880, AF113677, AI133080, AI122093, AF125948, AF104032, AI110225, X82434, A08909, Y16645, I33392, AI117460, AI137463, X72889, AJ238278, U35846, AF113690, AI133640, AF078844, X63574, AF090934, AI049452, AF017437, AF090943, AF017152, AI133075, AF113691, AF106862, AF113013, AI049314, AI117583, AI133606, AF118094, AI080124, AF087943, AF113699, E02349, AI117585, AI050138, AI133565, AI122123, E03348, E07361, AF113689, AI049382, AI096744, Y11254, AJ000937, S78214, AI050146, AF091084, AI049430, AR059958, AI133016, AI049466, U80742, AI133113,					
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HJMBX19	2459	668568	1 - 405	15 - 419	R32287, AA455162, AA456525, AA135649, and A1083959.
HJMB77	2460	772101	1 - 314	15 - 328	AW104918, and NG2731.
HJMB10	2461	964464	1 - 595	15 - 609	T92671, AP000309, AP000048, and AP000116.
HJMBQ90	2462	788834	1 - 543	15 - 557	A1912028, AW205965, AW204265, AA039572, and AA641146.
HJMBN02	2463	919737	1 - 470	15 - 484	AA557385, and AC005214.
HJMB193	2464	929114	1 - 390	15 - 404	AI090083, A1829485, AW205724, AA772573, AA845116, AA074956, AA115510, AW190595, AA022952, A1141599, AA628482, A1051949, AW371164, A1097055, A1890975, A1337839, AA736989, A1081563, A1041864, A1393834, A1469272, A1342319, AW338241, AW264160, A1583596, A1354880, A1183444, A1936936, AL047697, AA700866, N94495, AA543017, N93380, A1493628, N32842, AA026953, N35378, A1198542, A1033873, A1034219, A1092332, AW079884, A1862812, AA830087, T15721, A1268105, N48023, A1280189, A1766704, W79295, AA771789, AA693396, AW081435, A1923501, AA789217, A1690543, AA704989, N69040, AA192860, A1758815, R39361, R97800, A1820003, A1378456, A1672120, D62879, F05041, A1904662, A1266086, A1914468, AA699763, A1907483, AA788953, AA923476, N79464, AA888029, A1355472, W81453, A1634896, T41193, AA649798, AA649807, R01135, AA862997, A1302880, Z39546, N69916, AA343461, A1221819, A1266004, AA939287, D62955, AA526695, T32169, H23424, AW152231, A1829263, D79898, N40473, A1040552, A1933545, AA484853, AA913558, H00652, AW409609, T24050, AW002183, AW020740, D79437.

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HJMAV93	2465	828110	1 - 431	15 - 445		AI828559, N33343, AA512946, AW242837, AA776686, AA908183, AW402709, AA761704, AI088906, AA035207, AA045460, AI418843, AI362157, AW183346, R05828, AA627883, AA026236, C20746, and AA349140.
HJMAU07	2466	961623	1 - 488	15 - 502		AI631661, AI656482, AI655799, AW168207, AI745171, AI739521, AW073890, AW161625, AW157477, AW157176, AW002703, AW090343, AA738238, AI906428, AW293743, AW328076, AW328075, AA249074, AI991472, AI653282, AI652717, AI654896, AW393827, AW393832, AI203310, AW390900, AA776677, AW390889, AA381902, AW364462, N93494, AW160794, AW163150, AW161159, AI802780, AA974383, AB016089, AF201422, AB016092, AC004493, AB016088, and AF161338.
HJMAQ86	2467	785410	1 - 544	15 - 558		AA082617, AA082622, T49308, and U73643.
HJMAQ14	2468	657579	1 - 465	15 - 479		R25621, C04010, and C03959.
HJMAJ91	2469	811222	1 - 439	15 - 453		H96543, AA043831, AW250847, AI741631, AI741642, T72311, AI761422, AI992202, AI143894, AA194496, AA635765, AI992194, AA983373, AI890651, AI341988, AA336193, AI081852, C02956, T84215, D79135, AI050718, AA424281, AA348739, AA194697, AA029252, W51957, AI475478, AA370818, AA349624, N80191, AA216646, AI805451, AA907523, AI248525, AA565574, W48641, AA609560, AI077909, AA378570, AA112530, AW408361, AA161054, AI709345, AI497917, AI074107, AA150947, W38482, AA279104, AA654134, AI131385, H08872, AI138451, W07568, and C03234.
HJMAI62	2470	742612	1 - 343	15 - 357		AI927723, AA430100, AI749184, AA493808, AI755214, AI754567, AI061313, AI797998, AI355246, AI299442, AI754105, AI090334, AI336771, AA659923, AA904275, AI732458, AA127499, AA630854, AA669238, AW172727, AL048060, AI821881, AI821918, AI049845, AL046519, AW272815, AI791457, AI732501, AA526415, D44672, AI859438, AI283938, AW167154, AL079553, AW238495, AW439703, AA297208, AA714110, AI076236, R83585, AW008184, N42508, AA468322, AI801563, AA577755, AA480486, AW410983, N38991, AA593537, AI598003, AW021608, AI686703, AW407632, AA535216, R94909, AW002831, AA470496, AI078409, AI274691, AW167799, AW151247, AA297666, AA469230, AA309156, AA600202, AI049643, AI620992, AI862716, AI884404, AC002325, AC001644, AC005233, AC005768, AL121603, AC004999, AC005484, AC005031, AC005682, AC005697, U95739, AP000501, AC004878, AC006312, AF111168, AL121653, AL021391, AC004910, Z99716, AL132712, Z94721, AP000355, AC005619, AL050318, AC004033, AC005565, AF196779.

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HETLE29	2471	909762	1 - 404	15 - 418	AA960957, AI001155, and AC004664.
HETTY68	2472	752542	1 - 598	15 - 612	AW002051, AI634267, AI243174, AA436186, AA436311, AI431959, AI061116, AA761592, H06947, N23373, AA086090, and AA947734.
HETID12	2473	655199	1 - 497	15 - 511	AA054591, and AI090055.
HETH001	2474	921649	1 - 420	15 - 434	H73781, H73794, and AA250749.
HETHB18	2475	529467	1 - 233	15 - 247	
HETFF68	2476	529587	1 - 193	15 - 207	
HETFF43	2477	529589	1 - 190	15 - 204	AC002430, and AC007384.
HETDU61	2478	742157	1 - 407	15 - 421	R09668, W27308, AI017666, and T40006.
HETDA25	2479	677490	1 - 323	15 - 337	T75438, and AC005041.

HETCO27	2480	533536	1 - 101	15 - 115	AC004525.
HETCH01	2481	961038	1 - 577	15 - 591	T63959, A1903998, A1903827, A1903970, AA846926, A1903969, and T25149.
HETBM55	2482	929285	1 - 419	15 - 433	W58542, W58508, AA338107, AL110415, Z21137, AA677723, AB033071, and AL049742.
HETBE61	2483	965638	1 - 690	15 - 704	AA044700, A1217938, AA621573, A1341648, A1888183, AA448474, A1378270, A1377879, AA761808, AA908986, A1554608, A1499447, AA405744, A1658858, N94970, AA826528, AA845274, AA337749, AW104676, AA514257, AA450024, AA446662, N99058, A1200828, A1638236, AA749175, AA907567, A1860350, N30595, A1015967, W56551, R42965, T72602, AA496049, A1240555, A1628397, AA992373, F09967, A1680576, A1970903, AF120324, AF120323, and AF151833.
HETAS91	2484	790499	1 - 699	15 - 713	N40393, N27230, A1001868, W03460, AA336991, AA293193, AA456181, AA352669, AA404703, AA404253, AA455873, and AB029039.
HETAS81	2485	778539	1 - 272	15 - 286	AA195574.
HETAS62	2486	754155	1 - 475	15 - 489	N94153, AA337208, and AL021368.
HETAJ14	2487	660831	1 - 744	15 - 758	W73113, W73134, AA336749, and H71426.
HEQCC01	2488	924849	1 - 991	15 - 1005	A1984000, AW269830, A1801497, A1376738, W44650, A1951239, A1299070, W44651, A1277888, A1090780, A1460194, AA913912, AA889345, A1469976, A1277222, A1470014, A1302046, A1352112, W70230, H57665, AW385653, W70229, A1206087, Z24798, A1141926, W61319, H58505, AW129398, A1393721, W65404, AA092527, AW385674, AA853182, AA527482, A1147785, AA229903, A1916555, A1832158, AB037938, and AC004477.
HEQBT78	2489	773528	1 - 239	15 - 253	AA088215.
HEQBP18	2490	855578	1 - 451	15 - 465	AC005412, AP000212, AP000134, AC005081, AC002302, AC005015, AB003151, Z97055, Z85987, AC005899, AL035415, AC005088, AP000688, Z99128, AL139054, AL079295, AC004953, AC002094, AF196969, AF001549, AC006480, AC005914, Z81369, AC004966, AC005480, AF045555, AC004491, AC002544, AC006530, AC005011, AC004659, AP000553, AC003109, AC004815, U91323, AC006449, AF196971, AL034379, AP000689, AF064861, AC005225, AF030453, and AL050307.
HEQB109	2491	739877	1 - 241	15 - 255	A1682994, A1860517, R59606, AW128847, AA427939, AW089100, AA688398, AA678726, AA865152, A1301869, A1537473, A1635629, AA206817, A1635651, A1635668, A1589266, AA382581, N30811, W26239, AA522648, W51988, AA083277, AR068569, and E02783.
HEQBG85	2492	827915	1 - 262	15 - 276	AA242840, D31085, AA375146, AA329739, AA359153, AA375223, AA461165, AA852329, AA113413, AA461339, A1375044, D86983, and AF200348.
HEQBG60	2493	427813	1 - 366	15 - 380	C16876, AA194321, AA433852, C17161, AA180946, A1525618, A1557711, AA074286, C17197, C17260, A1061627, A1114766, AA632855, AL036120, A1110700, A1110702, A1733732, A1110877, A1133691, AA247674, AA469023, AA469454, A1557407, AA468291, AA469339, AA533497, C18679, A1791942, AW277101, C18086, A1525833, AA457778, A1557430, A1525740, A1525655, A1114723, AL037233, C17850, A1525594, A1110881,

HEQBE78	2494	772860	1 - 399	15 - 413	AI114736, AI557512, AI133606, AI557620, AA190509, AA099765, AI525675, C17646, AA496319, AI065146, AI110734, AI114585, C18308, AI133681, AA225972, AA211183, AA193158, C17276, AI133444, AI525609, AA149719, AA210993, AA193139, AI133323, AI111183, AA192142, AA650320, AL036950, AA985072, AA147287, AA263129, C17869, AA111992, AA730713, AI525223, AI525224, AI174851, AI133348, AI525704, C17777, AA213805, AA259235, AA214706, AA112937, AA187242, AI002878, AA095540, AI524915, AI525208, AI525308, AW270677, AA610217, AA096071, AA179575, AA226053, AA093633, AA192769, AI110870, AI525584, AA677781, AA092031, C18932, AA714096, AA211267, AA193022, AA193077, AA186774, AI557196, AA713554, AI541088, AA090151, AA090965, AA196107, AA180127, AA090969, AA088526, AA090214, AA085797, AA094071, AI678834, AA104032, AA096116, AI750078, AA083602, AA090907, AA579547, AA573649, AI557051, AI064914, AA177026, AA091026, AA093711, AA082180, C17762, D51282, AA090990, AA179142, AA090166, AA090807, AA130057, AA090943, AA197087, AA196431, AA187784, AI833114, AA195842, AI207615, AI720161, AA115803, AA180940, AI002718, AI557661, AA757623, AI133486, AA095787, AA603485, AA618243, AI147501, AA215934, AA090757, AA093442, AA659381, AI114764, AA249267, C18118, AA090144, AA092908, C17330, AA837217, AI459413, AI721213, C17357, AI114553, C18846, AA929066, AA094655, W56031, AI721239, AI114569, AA091885, AI720842, C17253, AA216092, AA089796, AA640485, AA196942, AI366461, AA091799, AA464911, AI832465, AA249171, AA091648, AI174902, AI525114, AI133302, AA094383, AA736456, AI557580, AA214119, AA467951, AA216196, AA176675, AA090764, AA071205, R2885, AA093449, AA653037, AA487737, AI985682, AA515626, AA131159, AA213941, AL047782, AA192982, C02686, AA559143, AI833042, AI114776, AA652805, AA985256, AA090427, AA641024, AA091970, AA090288, AI541480, AA092535, AA197267, L08441, I27367, X93334, X54629, J01415, X62996, V00662, D38112, AF134583, U35430, X93347, D38113, X93335, D38116, D38114, AB005535, and A70826.
HEQBE71	2495	760305	1 - 439	15 - 453	AC006254.
HEQAZ01	2496	916321	1 - 448	15 - 462	T89326.
HEQAM59	2497	739220	1 - 146	15 - 160	W20223, and AW300240.
HEQAK94	2498	793250	1 - 286	15 - 300	AI884723, AI971997, AW136547, AW168144, AI582351, AW028249, II111116, R36152, AI982536, R71232, AI926458, and AC004126.
HEQAF54	2499	729594	1 - 451	15 - 465	R53056, and H08598.
HEQAD73	2500	914044	1 - 579	15 - 593	AW291088, AA037761, AI937151, AA148558, AI207722, AA143058, AW242313, AA039270, AA150219, AW248839, AW134681, AA782955, AW044454, AI720406, AA159625, AI824032, AI359017, N44915, AW247279, AA136239, AW249260, AA136326, AA736535, AA312218, AA159616, AA165673, N33099, AI677832, AI869047, AI867484, AA159698, AW247893.

HEQAA93	2501	792255	1 - 546			AA934072, AA143176, D60324, R29152, AI590805, AW169153, N57511, AI393129, AI080402, H83533, N34512, AF161487, AF161527, AC007565, and AC007229.
HEPCB04	2502	941270	1 - 512	15 - 526		W92197, AI272825, AA016235, W94926, AI243425, AW082258, AW297127, AI241137, AI424820, AA813649, and AI289258.
HEPBO92	2503	952996	1 - 427	15 - 441		AI171709, AW003912, AI080595, AA235033, AA235201, AW450977, AI969306, AA193652, AA193549, AI928801, R22829, T69554, AA588382, N94214, N80329, R17380, AL023581, AF153605, and AF151861.
						W80428, AI281960, W58699, AA417821, AI191334, AA524259, AI140335, AI272028, AI198251, AI279567, AI077948, W58105, AA976989, AI279283, AA568684, N75444, AI768190, AA471035, AI042070, H27894, R69416, AI207043, AI093933, AA931805, AA057072, AA776787, AI356687, N89605, AI830795, H20193, AI125808, AI125797, AI160353, AI394538, AI336185, AI858974, AI352347, AI268758, AI298093, AI298398, AI268851, AI191106, AA976789, AI184456, AW000778, AA479904, AA976567, AI184383, N80954, AA328860, AA482453, AI338345, AI042254, N68172, N80657, AI813413, N68196, AI343021, AA705334, AA931904, AA532627, AA721003, AA715390, W69319, AW327781, AI301403, W58698, W58215, N68260, AA481706, W05193, N54740, AI086220, AA159198, AI369601, AI074994, AI184042, AW439353, W69215, AW149380, H03721, H19993, H83921, H02830, AA428492, AW071418, N80631, R98136, H83779, R69545, AI800014, AA603925, H20384, H72739, T35392, AI026120, H50256, AI370680, AI554686, AA356398, AA765315, AW150959, AW008524, AA513681, AA481467, and R48307.
HEPBO85	2504	783362	1 - 679	15 - 693		AI090010, AA779356, R70094, AI088640, R79670, R28363, R39498, and AF121177.
HEPAY26	2505	825778	1 - 180	15 - 194		AI678727, AI373871, AA335883, R47985, AI915014, and AA586390.
HEPAX40	2506	535627	1 - 726	15 - 740		AI888322, AA149051, AA149050, AI081764, AI985657, AI862905, AI082688, AI559607, AW151020, AI275490, AI824512, AI240781, AW294730, AI370307, AI925301, AI491857, H28424, H39903, D62631, AI956009, and AL137566.
HEPAX16	2507	667665	1 - 473	15 - 487		AI216316, N95121, AA524146, AA826400, AI572953, AA576084, AA243582, AA693835, AA648272, AA830864, AA872868, AI083498, AI278286, R64633, AI919073, F25383, AI624649, AI380699, AW027102, R64632, AA975873, AA971324, and AL035416.
HEPAQ35	2508	707533	1 - 520	15 - 534		T86787, N47173, AA335769, AA406114, AI560856, AA410382, and AA774453.
HEPAT34	2509	703336	1 - 669	15 - 683		AA458879, AW138005, AA406623, AI749863, AI299810, AI968830, AI084067, AI749131, AA335721, AI473485, AA976661, AA464428, AA411695, AW130055, C03960, AI880337, AI904562, AA864979, AA781665, AI198298, AA430699, AI275029, AA706499, AW206841, C01121, and AI695779.
HEPAN05	2510	932893	1 - 477	15 - 491		AI218711, AI918047, AI918977, AI288674, AI085618, AI139776, F29008, AA335421, AI929165, F35667, AC004751, and AC004646.
HEPAK04	2511	933039	1 - 477	15 - 491		AI004158, AA335529, AA847893, AI262232, AW292700, AI950883, AA808598, AW183055,

HEPAJ14	2512	657440	1 - 231			AA505961, AA478576, AA255751, A1468599, A1417159, A1678423, AW043579, A1333775, A1521274, AA009947, A1379044, A1089360, A1027938, AW173026, N49409, AA417796, AA173415, R94723, A1972464, W31503, H63962, A1703182, AW193647, A1741193, AA456887, AA470626, AA885985, D30922, and AC006557.
HEPAJ04	2513	933091	1 - 353			H26683, and AA335271.
HEPAE58	2514	509130	1 - 348			A1219496, A1187819, AW085963, AA335263, AA669515, AC007993, and AC002094.
HEPAE02	2515	921389	1 - 211			R46509, AA335475, AA335926, and Z63111.
HEGBC03	2516	922550	1 - 290			AA484651, AA335440, and AC004887.
HEGBB67	2517	751233	1 - 340			A1445299, AW005649, A1470184, AB032959, and AL021393.
HEGBA01	2518	915596	1 - 425			AW295266, A1765278, A1261553, A1367242, A1050799, A1433693, A1672068, A1308137, A1769877, AW003759, A1201838, H18343, A1761277, A1823875, R85423, H18100, A1760769, A1984928, AW149699, H20325, R84272, AA860751, A1369859, A1262936, A1474901, AA013231, AA013325, and H18141.
HEGAX04	2519	927260	1 - 522			T51466, and AC006333.
HEGAQ91	2520	789940	1 - 261			AA236038.
HEGAL55	2521	731654	1 - 423			H54234, AL037663, W84821, AJ012221, AJ007014, and AL031319.
HEGAJ08	2522	959216	1 - 557			A1962879, AA133284, A1863307, A1679213, AA768727, AA417760, A1083774, H95609, A1538225, AW409962, AA516124, AA417846, AW196578, AW074110, A1168476, A1825102, and A1885413.
HEGAC02	2523	918992	1 - 519			AA059456, AA040649, R60003, AA058951, A1970861, AA662962, AW268083, and AA045527.
HEEAY84	2524	782706	1 - 370			AA813370, and Z93016.
HEEAX09	2525	912065	1 - 400			N77524.
HEEAW40	2526	710655	1 - 385			AW305246, AA405462, and AA336099.
HEEAP59	2527	738892	1 - 401			AA176878, AA984649, and AB009973.
HEEAM25	2528	677599	1 - 771			AA083887.
HEEAH94	2529	794257	1 - 332			AA086139, A1088145, AW131790, A1857700, A1283095, A1813629, A1917113, A1478664, A1919281, A1967944, A1499083, A1655215, AW136596, A1767765, A1825582, W16832, AA831238, A1381212, AW028578, Z19309, AA912593, A1497888, H86248, AA019370, and AF061261.
HEEAH76	2530	769950	1 - 503			A1832117, and T60136.
HEEAH57	2531	734488	1 - 475			T90469.
HEEAH16	2532	661827	1 - 598			AA158378.
HEEAG51	2533	930810	1 - 430			W94212.
						T51329, R55106, AW298352, U73637, AF015416, and AF083108.

HBEAG12	2534	724929	1 - 546	15 - 560
				AA577763, AA633422, AI037129, AA400644, AI814562, AI951746, AI160713, AW273309, AI760380, AI829095, AI830606, AW410028, AA069839, AI762794, AA740152, AI079211, AI831826, AI436417, AA715294, AW248582, AI479090, AI446523, AI564707, AI580739, AI718353, AI114856, AI031714, AI979218, AW020139, AI927726, AI625558, AI803385, N63450, AI499665, AA609811, AI041488, AI559675, AA808909, AI805112, AA721567, AI356504, AW131446, AI371162, AI608666, AA621666, AW117835, N47802, AW303837, AI635165, AI792502, AI792459, AI681955, AI356534, AI741024, AA461161, AI371783, AW167885, AW269461, AA186776, AI961876, AI569468, AI983819, AI198692, AI677976, AI580884, AI285382, AI627469, W69718, AI684007, N26300, AI053500, AA465244, AI568377, AW082099, AI187296, AI122688, AI619582, AI923356, AI053500, AI114801, AI361711, AI538412, AI475683, AA569404, AW131064, N62435, AI378096, AI114801, AI361711, AI538412, AI053809, AW102909, AI284485, AA609804, AA157510, AA983155, AA719436, N69868, AI581694, AA813458, AI025704, AW068095, AA730994, N49709, AI254995, AA772777, AI272877, AI025243, N68207, AA074131, W29008, AI241762, AA069789, N49747, AW001954, AI635898, AW167269, AI821623, N24969, AI565122, AA679739, AW295592, AI708945, AA426103, AI129305, H81268, T57228, AA454089, AA173256, AA570192, AW167442, H88671, AI888551, AW130022, AA218723, AA490126, AA160557, AA629812, AW316580, T48377, W07841, AW238570, AA402187, N64337, AI401141, AA582071, AA582069, N71249, W28998, AA878904, AI537917, AA398896, AA393126, AA158019, AW028732, W81377, AW117980, AI587486, AA385065, N67689, AI686807, AI969514, AA070932, R69118, N55579, AI951358, AA501522, AI690866, R82294, R69237, AI866191, AA069566, AA807712, W95312, AI539138, AW151663, R49753, AA557272, F27924, AI200767, AW073563, W94577, AA861022, AI074168, AA490869, AI682865, AA719453, H89972, HI6003, AA972251, AA888800, AA311106, AA479531, AA158667, AA725811, AA365495, AI751587, AI624034, AA015906, AA569951, T74260, H93995, AA716314, AA452503, AA863083, AA506968, H02178, AA429696, AA427565, AA720992, H43481, F26439, AA828474, T55982, AA504793, R27973, AW193086, AI001209, AA630055, AI791854, AI886874, AI752142, AA255883, AI359741, AA340175, AA031466, AA427714, N79151, R46819, H53048, DI1678, AW014403, T55334, AA485288, AW316811, AA429565, AA832289, AA398182, F27649, H88719, AA015746, AA046017, AI289762, H86474, R85355, W78088, R68012, AA485423, F22385, N49815, H60678, X07417, AI238283, AB026899, AP000352, Z75889, AP000500, AL031057, AL031430, AC005192, AL118497, AP000345, AL021394, AC006077, Z69705, AC005013, AC007372, AC005681, AC004754, AC004757, AL049837, AL109938, AC005667, AL024507, AF186194, AF020802, Z75746, AC005881, AC005530, AC002544, AC007666, AC006132, AB023056, AF165926, AC007999, L09706, AC000378, AC000052, AC005206, AL031671, Z83843, AP000555, AJ004799, AC002487,

					AL031391, AC006344, AC004019, AF019413, AC006539, AP000502, Z11740, AL109847, AP000514, AL049839, AB014080, AC004067, AP000520, AF117829, AP000687, AC005204, AC006039, AC004558, AJ229041, AL022721, AC007066, AC002295, AC006441, AC004206, AL096773, Z83826, Z83841, AC004887, AC005962, AL034394, Z94054, AC005694, AC004860, AC004167, AC003991, U91326, AC007687, AC006952, AL023875, AJ011930, AL117356, Z82976, AP000354, AL050321, Z98742, AC006222, Y18000, AC020663, AC003663, AC005570, AC008981, AL034421, AC002525, AC004448, AC004858, Z83844, AB023048, AL035407, AL022101, AP000511, AL133246, AL031685, AC006251, AL023575, AF109076, AC005006, AL135745, AJ003147, AF165147, AF109907, AC006008, AF050154, AC005529, AL133243, AC006427, AL049653, AL035458, AC004520, AL096703, AC005034, AC004021, AC006198, AC006236, AC005531, AL022332, AC006992, AC004922, AL035073, AC009731, Z98304, AL021877, AL079342, AF129077, AC007546, AC007860, AC004912, AC006449, AL035455, AC002299, AL121756, AL121653, AC006557, U92032, Z84489, AF053356, AC005510, AC004655, AL035681, AP000432, AC006121, AC004813, AL020995, AC005324, AF111169, AL031650, AC008282, AC005913, AC006011, AC005829, AL031594, AL022401, AL049776, AL133312, AC016027, AC004213, AL021918, AP000350, AP000457, AC005343, AL022400, AC007225, AC005668, AC002375, AC007172, Z93403, AL133245, Z93017, AL034402, AL035608, Z84487, AC005874, AF134471, AL022723, Z95889, AL136504, AF107885, AL133297, AL109758, AC000353, AC005828, AC004474, AL031602, AF134726, Z69710, AL121577, Z73900, AC007560, AL021938, AC006120, AC006026, AC008101, AC007376, AL021154, AF011889, AC002531, AB000879, AC005971, AB000882, AC002402, AC002455, L34079, AL020997, AC007387, AL137191, AC000134, AL135879, AL121790, Z95437, AL034430, AC005320, Z82203, AC005684, AP000506, Z82215, AC015853, AL008583, AC004973, AC004158, AC005832, AC005060, AC002996, AC016830, AL133304, AC003102, AC002536, AC009241, AF052041, AC006313, AL049539, AC007283, Z82196, AC005567, AC007298, AJ010395, AC004762, AL049757, and AL021397, N44039.
HEEAD13	2535	470886	1 - 182	15 - 196	R08794, AI470646, AA506458, AA303007, AI002941, AI933534, AI691091, AI903462, AW380254, AA011026, AW021735, AW275510, AA493695, AA321168, AA455670, AW089101, AI311927, AA131035, AI933658, AA019312, AA635739, AW338179, AA676971, AI460009, AW004884, AA788982, AA188676, AI633390, AL045739, AI584186, AA679154, AI431240, AI469968, AA179944, AI888752, AI005388, AI872020, AI927741, AA834707, AA223174, AA358515, AA527209, AL042225, AA847515, F25733, AW193461, AA600869, AW022897, AA101689, AI268334, AI268336, AW276827, AL120343, AL046205, AA572713, AA584612, AI687343, AI249573, AI696595, R07234, AW023865, AW168618, AW270343, R68223, AW265009, C75026, AA467820, AI611569, AI611598, AL043009, AL045053,
HEEAB40	2536	710668	1 - 414	15 - 428	

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HEAAX26	2537	684734	1 - 264	15 - 278	U75931, Z81450, AP000302, AC005525, AC006127, AC006138, AF037338, AC005202, AC004755, AC005624, AC005568, Z69733, AC002499, Z70688, AF050154, AC007565, AC006277, Z93024, AC005777, AC004643, AL049856, AC004209, Z70051, AC006139, AL080242, AC004696, AL121934, and AC002037.
HEAAU20	2538	911255	1 - 443	15 - 457	H97463.
HEAAR47	2539	973284	1 - 444	15 - 458	H91826, and Z97989.
HEAAR21	2540	883939	1 - 522	15 - 536	AC004672.
HEAAN43	2541	842032	1 - 323	15 - 337	AW295831, A1369420, AW298562, AW151269, and AC005146.
HEAAM71	2542	950736	1 - 612	15 - 626	R97645.
HEAAL76	2543	770200	1 - 425	15 - 439	T87255, AA078363, and AC008039.
HEAAG84	2544	896892	1 - 591	15 - 605	AA169155, and A1741303.
HEAAG42	2545	714041	1 - 1098	15 - 1112	AA044749, AA135685, AA135713, AA156933, AA099390, AA099389, R67663, AA135671, R66064, R24427, AA044673, AA043522, and AA043523.
HEAAB66	2546	844361	1 - 804	15 - 818	A1340603, AL037454, A1358042, A1308035, A1678409, AW268060, A1345347, AA806719, AW302973, AW089275, A1445069, AA088789, A1561356, AA464646, A1656270, A1906328, A1582966, A1571511, AA417129, A1581139, A1537677, A1568060, AW059828, A1623941, A1951062, A1950973, AL038778, A1365256, A1242248, A1434731, A1281687, AW059713, F36859, A1621341, A1539153, A1345131, A1472536, A1473451, AW148970, A1207454, A1446373, AW193467, AL118781, AW078805, AW082532, AA911767, A1678446, A1336575, AW090279, A1868163, A1537643, AL041115, AW084097, A1284509, A1570257, A1267185, AA070889, A1348901, A1636197, AL047042, AW021717, A1624304, AL037582, AW150826, AL037602, A1570966, A1469505, A1697324, A1280607, AL039086, A1699011, A1446823, A1114703, A1345253, A1589428, A1345677, A1349933, A1859464, A1886594, AW021091, A1917963, A1628325, A1800464, A1468970, AA493923, AL040241, A1687568, A1050666, A1866469, AW085786, AW172975, AW020419, A1799674, A1312210, A1452876, A1491710, A1801556, A1963040, A1345745, A1366922, AW302924, A1400725, AL036638, A1560679, A1873638, A1634919, A1633321, A1565172, A1623736, A1554487, A1915295, AW088560, A1583578, A1684021, AW169671, A1539800, AL048351, A1470293, A1885989, A1567582, AA587590, A1472566, A1916419, AW163834, A1866608, AW082600, AA916133, A1933992, A1671669, AL039276, AA830396, A1521560, AW051088, A1671651, AW161202, A1309306, A1610357, A1439020, AL048323, AW151136, AW044029, A1886415, AW411235, A1421091, A1683559, A1251221, AA853213, AL048340, A1269205, A1499915, A1263331, A1446124, A1345688, A1366875, A1360560, AA019328, A1590702, A1291973, AW080214, AA853539, AA127565, AW191844, A1310332, AA807088, AL036954, AW076127, A1866082, AW411351, AA099519, A1401697, A1811422, A1559863, AL042382, A1865320, AW409775, AW088899,

	F34866, H89138, AW403717, AW190725, AI696969, AW058233, AI270099, AL047387, AI648663, AI679622, AW268261, AW082623, AW020095, AI923989, AW151850, AI419650, AW131112, AI249877, AW150326, AW132107, AI524654, F33262, NG3128, AW081383, AI874151, AL038575, W60514, AI801325, AI333104, AL036772, AI929108, AI539771, AI554343, AI620093, AI537837, AI334445, AW410609, AI612721, AL046463, AI573026, AL047344, AI270295, AA908294, AI095113, AW089006, AW088944, AI624529, AI805688, AI306562, AI521108, AI611743, NZ5081, AI289791, AI349957, AW083804, AW168503, AI520765, AA830821, AI590423, AI479577, AI912531, AI888621, AI336634, AI696626, AI357599, AA292158, AA848053, AA761557, AI589993, AW149876, AW079334, AI310940, AI866465, AI345005, AC002404, AL133104, AL110196, I33392, AI8777, I41145, AL137480, I48978, AF113019, U77594, AF118094, AL133072, Y11587, S77771, AL080154, AF000145, I89947, AL080159, I17544, AF044323, AR038854, Y10080, L30117, A08913, AF162270, A08910, A08911, A08909, A76337, A08916, A08912, AF036941, A57389, A08907, AF067420, A08908, AR029490, I42402, AL133016, A45787, AL133014, AL133619, U49908, U67958, AL133081, AF030513, S76508, I89931, I89934, I49625, AL117416, AF079765, AF061573, AL137478, AF159615, X84990, E06743, AF117657, AL137547, U80742, AL137294, AL049324, AL137556, L19437, Y10823, U92068, AF107847, AF061795, AF151685, AL050138, AJ006417, U72620, Y10823, U92068, AF111112, A21103, Y16645, X87582, E05822, AL122106, AL117460, AR034821, E02221, A18788, D55641, AF095901, AC002467, AF012536, AF137367, AL137292, AL137258, AL049465, AF026816, AL049464, AF028823, AF022813, I48979, X63162, AF183393, AF205861, AL137256, X66975, A12297, D83989, AL110171, AF113689, AF126247, AL049339, AL137557, X79812, AF215669, AF118070, AL137574, AL117578, AL133075, I66342, AF015958, S68736, AF185576, AL117435, AL137555, M92439, U51587, AL110218, AR068753, AR068751, AF207750, AF132676, AF061836, E01314, AL023657, AL137660, AL137705, X53387, AL080060, AF003737, Y11254, AF065135, A76335, AL137538, X55446, I92592, U96683, AF090900, AL050108, I68732, A93016, I89944, AF119337, AF091084, E15582, L13297, AL137530, AF094480, AF185614, Z37987, Y14314, AF113676, AF016271, X72387, X93495, AL137548, AR053103, AL137463, X82434, S36676, AF067728, AL049460, AL137640, AF118090, AF115392, AF118092, AL080110, AL137536, AL110221, AL050149, AF199027, AJ003118, AF158248, AF061981, AL137488, AL080148, AF139986, AL117629, AL137550, E01614, E13364, AL080163, Z97214, AF016047, AL122045, AL133560, AL133558, AL133640, AL117626, E12806, AF200464, AF151109, AL122098, AL122100, A07647, I09499, AL117440, AF146568, AF180525, AL080137, U72621, AF008439, AL137476, AL137691, AC007298, Y10655, AL137627, Y16258, AF114170, Y16257, E02756, Y16256, AL137526, A07588, E04233, L40363, AL133645, AF113699, X80340, AR038969, AF210052, E01818, AI133624
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HCORB05	2547	928679	1 - 426	15 - 440	<p>AF026124, AF047716, M96857, AF039138, AF039137, A27171, AF081571, U78525, AL110224, AL122121, AF057300, AF057299, AF182215, X83508, AL137300, AF179633, AF169154, AL080086, AL137429, X66862, I09360, and AL133093.</p> <p>AI343543, AA580865, AA932494, AA581041, AL119399, AL042544, AL042382, AL119457, AL079794, AL043168, AL043152, AI345347, AL119511, AI698391, AI624293, AI627988, AI890907, AW161156, AI002285, AW130930, AI868931, AI682798, AI866770, AI884318, AW051088, AI886753, AI572096, AI270429, AI473536, AI624120, AW130534, AI889189, AI918449, AI620284, AI538850, AI587121, AI491775, AI702073, AI079963, AI037454, AI570807, AW163834, AI538055, AI499890, AL120853, AI824576, AI433157, AI916419, AI241923, AL039086, AL119863, AI270183, AL043355, AI633125, AL037582, AL037602, AI538564, AI915291, AW152182, AI580436, AI670009, AI918435, AL038445, AI445992, AI923989, AW169604, AA806720, AW021717, AI627893, AI863382, AL037649, AI866469, AI493567, AI917252, AW080746, AI500061, AW192687, AI866083, AI961589, AA641818, AI686906, AI567582, AI267162, AI799183, AI671642, AI919500, AI567769, AI582932, AL079741, AI521560, R32821, AI950729, AI963846, AW167083, AI954183, AI612913, AW050850, AL121014, AI802542, AW238688, AI623941, AL036274, W74529, AI890507, AI207656, AI969655, AW129659, AI446373, AW131294, AI579901, AL036638, AW129230, AI919534, AL041734, AW151136, AI445990, AI926878, AI631095, AI872423, AI635016, AL036673, AI932794, AI536738, AI434741, AI874261, AI285448, AW193911, N29277, AI766348, AI452560, AW020397, AI889376, AI648509, AI572021, AW161579, AI866040, AL041772, AI280607, AW022699, AI859991, AI537261, AI623179, AI799408, AI254226, AI630252, AI923370, AA579618, AI869125, AI440239, AL038605, AI434468, AW162194, AI345416, AI802240, AI345612, AI270706, AW051258, AL045500, AW079409, AI288305, AI554821, AL134259, AI690748, AL046595, AW303152, AW026882, AW020419, AI609069, AI522052, AI345415, AA740450, AI889372, AL048496, AW149925, AI571439, AI860003, AI800155, AI963458, AI345778, AA420722, AW089275, AI874166, AI702068, AI284517, AI702406, AW243886, AI127565, AL046200, AI284484, AI801152, AI288285, AW083374, AI612750, AW192652, AL119324, AI698427, AI540674, AA502794, N33175, AI685517, AI559619, AW020693, AI471282, AI954504, AI884528, AI499963, AW149026, AI580198, AI493576, AW198090, AW118518, AI917963, AI345745, AI538764, AI500588, AI866465, AI284131, AW090071, AW160916, AI651840, AI815232, AW168452, AI281762, AW006032, AI866457, AI630928, AI590630, AI242248, AI439452, AI590830, AA908294, AI863191, AI355779, AI628331, AW090736, AI499986, AW102864, AI354630, AI619502, AL040241, AI951950, AL036802, AI768496, AL121365, AI870192, AI866090, AI536574, AI287233, AI635067, U77594, Y11587, I89947, AF139986, I48978, I33392, Z82022, AF158248, U35846, AF090900, A08910, A08909, AR013797, AR038854, A77033, A77035, AF111849, AF177401,</p>
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HCOPM06	2548	933473	1 - 616	15 - 630	AI494320, AI289626, AA349607, and AC004230.
HCOP107	2549	951645	1 - 399	15 - 413	AA683346, AI991127, and AW385510.
HCOPF07	2550	951655	1 - 476	15 - 490	AI027619, AA926665, AA954546, AA398085, AA621275, AA634531, and AA724256.
HCOOF07	2551	951693	1 - 504	15 - 518	AI160370, AA993156, and AW269609.
HCONP02	2552	917577	1 - 332	15 - 346	AA226397, H29285, Z39193, and D61466.
HCONM33	2553	971637	1 - 463	15 - 477	AI339840, N40932, AW044507, AI216527, AI620878, AW316937, AI292180, AI358083, AI954691, AW006263, AA321122, AA321123, AI654341, N46790, AI953114, N69895, AI970523, AA226346, AA226347, and AF196969.
HCOMM05	2554	925952	1 - 1647	15 - 1661	AI681802, AA534542, AL044632, AI912061, AI912050, AI271683, AA587766, AA143726,

AA565889, AI298280, AA079779, AI983603, AI052230, AI369272, AI148467, AI028441, N93876, AI950520, AW024410, AW138648, AI933105, AI244430, AA436795, AA583571, AA079751, AA595313, AA158795, AI373637, AA947417, R27340, AW182724, AW381284, AI869920, AI348932, AI244362, AI335320, AI305978, AI991003, AI250467, AI335365, AI611516, AI252717, AW086414, AI252210, AI310178, AI252203, AI345138, AI308005, AI310659, AI250541, AI311180, AI250964, AW301779, AI348928, AW086115, AI250009, AI311179, AI345868, AI305732, AI311504, AW303046, AI269522, AI254155, AI335130, AW301495, AI251162, AI862506, AI371584, AI311043, AI251045, AI590436, AI284537, AI310038, AW301422, AI224292, AI252538, AI053635, AA158794, AI862262, AW268255, D31472, AI685886, AW371409, AI540612, AW071370, W40369, AI886550, AW371414, AI955911, AI024888, AA143739, AI254135, AI246935, AW177721, T35070, C00345, AW371416, AA902858, AW369434, AA581215, AW117919, AI932915, AI554245, AW132056, AI800433, N80094, AI358213, AW088899, AI539153, AI919107, AI680457, AI802833, AW020095, AA946741, AI698401, AL110306, AW118398, AI251830, AL041772, AI805769, AI929108, AI468872, AI680280, AI251205, AI888621, AL046356, AW195957, AW002342, AI889953, AI659795, AI520809, AI569309, AW151785, AI498579, AI478123, AL119791, AI922901, AW198075, AW088134, AI432736, AI610645, AI587606, AI699011, AI476109, AI697324, AI335214, AW081255, AI868831, AW073994, AI888944, AW189415, AI280670, AI590686, AI783861, AL119863, AI866608, AI886124, AI345746, AI680498, AI628217, AI802240, AL040241, AI687065, AI469738, AI805688, AI249877, AI345677, AI952920, AI431909, AI633062, AW406745, AI343059, AI376180, AW168031, AI682743, AI349933, AI689175, AI345608, AW084219, AW103886, AI933785, AI633419, AI922577, AW071417, AI554218, AA225339, AI866002, AI433976, AI800138, AI828731, AW079159, AW191844, AI619716, AI696626, AI824576, AI612759, AW089179, AW151729, AI696819, AI867042, AI566630, AI689571, AI280661, AI636619, AI955866, AI537617, AI919345, AI800453, AI812015, AW105620, AI961310, AI963216, AI590120, AI494201, AW082594, AI627880, AI308032, AI282326, AI866770, AI400725, AI345471, AI366549, AW148716, AI636719, AI648684, AI344785, AI249962, AI866741, AI868931, AL043326, AW020693, AI801322, AW088903, AW151714, AI364788, AW085681, AW129230, AI611743, AI471361, AW083804, AI493559, AI628833, AI696533, AI589993, AI365256, AW151136, AI539771, AW059837, AL137526, I48978, AL050138, AL080127, AF078844, A65341, AL122098, I42402, A08916, I48979, AL080060, I89947, AF026816, X84990, A08913, I89931, AF158248, A08910, I49625, AF061943, A08909, AF017152, AL049382, AL050277, AF125949, AF104032, AL137538, S68736, AL080074, AF177401, AL133014, AL122121, AF162270, S78214, AL122093, AL133606, AF003737, AF113689, U67958, AR059958, A45787, AL117440, AF111112, AL137556, E03348, AR000496, U39656, U96683, AL133560, AR038969, Y11587, AL137271,					
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HCHQA48	2555	908495	1 - 558	15 - 572	R71963, and AF201303.
HCHOX63	2556	957690	1 - 942	15 - 956	W52941, H61325, AW024501, AA594317, AW182848, H55390, Z83838, and Z93244.
HCHNW48	2557	862478	1 - 312	15 - 326	AA778950.
HCHMX82	2558	850340	1 - 566	15 - 580	W85822, A1379248, AA935747, W85821, and AF111167.
HCHMW18	2559	966985	1 - 524	15 - 538	W30916, N99978, A1660617, AA307815, AW166174, AA877685, A1692837, F07221, A1123170, A1906507, AW390249, AA078788, and AB017614.
HCHMJ89	2560	786765	1 - 300	15 - 314	T79918.
HCHM196	2561	800129	1 - 567	15 - 581	U91323.
HCHM115	2562	935298	1 - 946	15 - 960	A1202736, AL134545, AW298000, AA126125, R54251, H12916, A1497978, AW296905, T35758, A1347137, AA190916, Z42146, A1989727, R96064, AL050318, AB023181, and U67140.
HCHC107	2563	952957	1 - 486	15 - 500	AA777369, AA700323, A1243088, AW292657, AW292654, and AL031666.

HCHCH68	2564	859084	1 - 488	15 - 502	AA494453, T75265, R51391, T78355, AA368764, R61709, AA101560, R35616, and Z25135.
HCHCG28	2565	686431	1 - 590	15 - 604	T77459, AA052981, T89679, A1138597, AW104281, AW050704, AA053474, T78622, AA677771, AW207204, A1049552, AA005222, AA51524, H07942, C01507, and A1367213.
HCHCE78	2566	773428	1 - 226	15 - 240	<p> A1142134, AL038838, AL037436, AL038822, AL037295, AL038983, AL040617, AL04186, AL041238, AL047012, AL044037, AL047170, AL040463, AL040576, AL041752, AL045684, AL038532, AL040625, AL037727, AL047219, AL04162, AL040839, AL043677, AL040193, AL043467, AL040510, AL040621, AL043538, AL047183, AL043496, AL040464, AL046442, AL041133, AL041324, AL037435, AL043492, AL040332, AL041602, AL041098, AL044125, AL041347, AL041096, AL041635, AL045753, AL043923, AL043814, AL040294, AL043845, AL038761, AL044074, AL044064, AL041955, AL041459, AL041577, AL041730, AL040052, AL041523, AL043627, AL040472, AL041374, AL046850, AL040768, AL043848, AL040444, AL042135, AL043570, AL046994, AL046914, AL039316, AL046392, AL045671, AL041246, AL049018, AL045990, AL039643, AL037341, AL037343, AL037335, AL045857, AL079852, AL037443, AL037323, AL037279, AL039432, AL042096, AL042898, AL038745, AL039360, AL134524, AL043941, AL045817, A1547295, A1547006, AL040075, AL045328, AL041163, A1541506, AL041296, A1526186, AL040119, A1547039, AL044272, AL046327, AL041086, AL044258, AL040149, AL041168, A1526194, AL044199, AL041159, AL041344, AL047057, AL045920, AL040148, AL041358, AL044201, AL040458, AL044187, A1526073, AL041233, A1546855, AL041292, AL041346, AL040571, AL041142, AL040332, AL044529, AL039338, AL040529, AL079878, AL041197, AL046330, AL040745, AL040370, AL044274, AL040128, A1525320, AL047036, AL045989, AL047163, AL040342, AL040553, AL041186, C16305, AA585476, AL040414, AL041277, AL039744, A1526187, AL134110, AL040285, AL040155, AL040091, AL044165, AL043440, R28735, AL041131, AL040090, AL041051, AL040168, AL043775, A1526176, AL041278, R29177, A1557084, AL041140, AL045327, A1525306, AL040255, AL040082, AL043444, AL040329, AL046150, AL041140, AL045327, A1525306, AL040255, A1541345, AL040385, AL040238, A1541535, A1535660, A1535639, A1546899, A1546921, AL040263, A1541356, A1526184, A1557262, AL045725, AL038651, D61254, D29033, AL043612, AL039915, AL049069, AL043537, AL046147, AL041210, AL080031, T23957, A1557787, A1557864, AL046097, A1557279, AJ239433, A1525321, T23888, Z28355, A1541510, A1557727, T23985, A1541527, Z30131, A1541365, A1557148, A1541013, A1525203, A1540967, A1557807, AL048677, A1541374, A1525556, R29218, A1547250, AL045211, A1525431, C15189, A1557734, A1546945, A1541514, A1546999, AL046099, AA585439, A1541509, A1541307, A1547291, A1541523, D57186, AA585101, AL045994, AL045340, I08396, AR064707, AR038762, I08389, AR035975, AR035977, U94592, A1230935, Y09813, I19525, X81969, A1230902, I66487, E13740, AR009151, D13509, Y16359, I66485, AJ238010, A91750, I15718, I08395, I15717, AR066494, M28262, AJ230951, AR031566, A85395, A85476, E03627. </p>

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HCHBQ27	2567	682308	1 - 232	15 - 246	<p>AI142134, AL037436, AL038838, AL038983, AL037295, AL037435, AL037727, AL038532, AL038822, AL037323, AL037443, AL040617, AL044186, AL041238, AL047012, AL040294, AL041635, AL044037, AL045817, AL047170, AL040463, AL040576, AL045753, AL041752, AL045684, AL040625, AL047219, AL044162, AL043923, AL043814, AL044074, AL041602, AL043492, AL040839, AL043677, AL040193, AL043467, AL040510, AL037343, AL043845, AL037335, AL040621, AL043538, AL047183, AL043496, AL040464, AL046442, AL040472, AL044064, AL041730, AL041523, AL041133, AL043627, AL041459, AL041577, AL041324, AL040052, AL040322, AL040444, AL040149, AL041374, AL041098, AL046850, AL040768, AL046994, AL040119, AL041955, AL043848, AL046914, AL043570, AL042135, AL041096, AL044125, AL045920, AL040075, AL041163, AL044272, AL039316, AL047057, AL041347, AL046392, AL045671, AL040458, AL041159, AL038761, AL044199, AL041292, AL041358, AL041168, AL044187, AL044258, AL041296, AL040148, AL040332, AL045990, AL041142, AL041346, AL041086, AL049018, AL040529, AL040370, AL040745, AL046330, AL041197, AL046327, AL040128, AL047036, AL041233, AL040342, AL040571, AL040553, AL041246, AL039338, AL044274, AL040285, AL079878, AI041277, AL042096, AL044165, AL040091, AL040155, AL039360, AL041186, AL041131, AL039744, AL037341, AI045989, AL040414.</p>

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HCHBM26	2569	681404	1 - 140	15 - 154		<p> AI142134, AL038838, AL037343, AL038983, AL037436, AL037335, AL037323, AI547295, AL037443, AL037727, AL038532, AL134524, AL044125, AL038822, AL040193, AL037435, AL044162, AL041347, AL047012, AL040621, AL043538, AL043496, AL043923, AL043814, AL041238, AL044186, AL040617, AL041324, AL043845, AL040463, AL047170, AL038761, AL044037, AL041635, AL040294, AL044064, AL041459, AL041577, AL047219, AL040464, AL040625, AL040576, AL045684, AL041752, AL045753, AL037295, AL046850, AL040768, AL041098, AL046994, AL046914, AL040052, AL040510, AL043467, AL040444, AL043677, AL040839, AL047183, AL043492, AL041602, AL041246, AL044074, AL041730, AL041523, AL043627, AL041374, AL043848, AL043570, AL040472, AL042135, AL046442, AL040075, AL041133, AL045671, AL045817, AL041955, AL040322, AL039316, AL045328, AL041296, AL041096, AL046392, AL040119, AL039360, AL041163, AL044272, AL041086, AL044258, AL042096, AL040149, AL041168, AL044199, AL041159, AL047057, AL045920, AL040148, AL049018, AL041358, AL038745, AL040458, AL044187, AL041233, AL039643, AL041292, AL041346, AL045990, AL040571, AL041142, AL040332, AL042898, AL037341, AL039338, AL040529, AL079878, AL041197, AL046330, AL040745, AL040370, AL044274, AL040128, AL047163, AL043941, AL134110, AL047036, AL040342, AL040553, AL041186, AL040414, AL041277, AL039744, AL044201, AL040285, AL045989, AL040155, AL040091, AL044165, AL046327, AL041131, AL040090, AL041051, AL040168, AL079852, AL043775, AL041278, AL039432, AL040253, AL045327, AL041227, AL037279, AL040082, AL043444, AL045857, AL040329, AL040255, AL040238, AL041140, AL038651, AL040263, D29033, AL045725, AL039915, AL043612, AL048677, AI547291, AL041210, AL044529, AI318479, AL041344, AL049069, R29218, AA585325, R28895, AA283326, T10982, R28967, AL038878, R28965, AA174170, R28892, R29262, T11028, R45895, R28735, R29445, AL038024, AL048714, R29177, AA585476, R29172, AL045211, AL047340, AA585101, D61254, Z28355, AI546875, AI557734, AI526176, AI557864, AI541356, AI525306, AI557262, T18597, AL043537, D57491, C16300, T23957, T23985, D59436, R29179, AI526184, AI541508, AI525500, AI525431, AI541523, AI547006, AI546999, AI525556, AI547250, Z32822, D52233, C14723, AL048657, AI541374, AA585439, C16293, D53472, C16305, AI557787, AI526194, AI541514, AI546945, AI540967, AI541390, AI557763, AI541205, AA585329, T41289, AI557731, AI541365, C15737, D57186, AI541533, AI557740, AI557727, AI541535, AR064707, AJ238010, AR066494, </p>

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HCHA162	2570	743411	1 - 135	- 15 - 149		<p>AL134524, AL045327, AL045328, AL047163, AL042898, AL134110, AL038838, AL037343, AL547295, AL037295, AL038983, AL142134, AL037436, AL037335, AL037323, AL037727, AL037443, AL038532, AL038878, AL044125, AL047037, AL037435, AL038822, AL041347, AL040193, AL043923, AL043814, AL047012, AL041238, AL044162, AL044186, AL040617, AL043845, AL038761, AL043496, AL040463, AL047170, AL044037, AL041635, AL040294, AL044064, AL041459, AL041577, AL047219, AL040576, AL040625, AL045684, AL043538, AL041752, AL040621, AL045753, AL046850, AL040768, AL046994, AL046914, AL040052, AL040444, AL040464, AL040510, AL043467, AL043677, AL040839, AL043492, AL041602, AL044074, AL041730, AL041523, AL043627, AL041374, AL047183, AL043848, AL043570, AL040472, AL042135, AL041324, AL046442, AL041133, AL045671, AL041098, AL039643, AL041955, AL045817, AL039316, AL040322, AL040075, AL046392, AL039360, AL040119, AL038651, AL041096, AL044272, AL041246, U46344, AL044258, AL042096, AL041168, AL041163, AL044199, D29033, AL041159, AL045920, AL040148, AL047057, AL040149, AL041296, AL049018, AL040458, AL044187, AL041358, AL041086, AL038745, AL041292, AL045990, AL040571, AL041346, AL041142, AL040332, AL043941, AL039338, AL079878, AL040529, AL135012, AL041233, AL037341, AL041197, AL046330, AL044274, AL040745, AL040370, AL040128, AL079852, AL039432, AL040553, AL048677, AL047036, AL045989,</p>

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HCHAH04	2571	487985	1 - 61	15 - 75	
HCHAG52	2572	726081	1 - 395	15 - 409	
HCDMF96	2573	796196	1 - 418	15 - 432	AL0459248, AL0701427, AL0233601, and N91037.
HCDME32	2574	863374	1 - 593	15 - 607	AA045957, AA416555, T19219, AL034902, AL042134, AL019355, U46349, AL019457, AL043004, U46346, and AR066494.
HCDMC86	2575	785134	1 - 316	-15 - 330	AL067571, AA977468, AW183837, AL0208676, AA401383, AL0184678, AL016502, AA448192, and AA927251.
HCDMC25	2576	677627	1 - 565	15 - 579	H10593, and AL021385.
HCDMC23	2577	675490	1 - 354	15 - 368	
HCDMC22	2578	672815	1 - 228	15 - 242	AL0119791, AL018280, AL011348, AW149236, AL0252023, AL0590830, AL0677351, AL0866753, AL0866798, AL040241, AL038445, AL046373, AL0285826, AL0345745, AL046538, AL080498, AW268122, AL040603, AA572758, AL036631, AL0288285, AW161579, AL012428, AL023989, AL0567612, AL0866770, AA012905, AL0783504, AW163834, AW0302965, AL036638, AL048854, AL040169, AL037677, AL0802240, AL021463, AW088899, AL045347, AA420722, AW151138, AL053885, AL0500659, AL0570861, AL01917252, AL0468684, AL0431424, AL0499986, AL0589267, F37471, AL0500523, AL0865906, AL0246319, AL0335426, AL0590423, AL048777, AL0457188, AL089168, AW132034, AW188382, AL036146, AA493647, AL0633419, AW089572, AL026800, AL051232, AL0249497, AW074993, AL0349614, AW238730, AW268253, AA225339, AL0312152, AL0284131, AL0873644, AW149227, AL0345735, AL0344785, AL027988, AL023370, AL0569583, AL079963, AL038605, AL020284, AL0254727, AL0640779, AL0349937, AL0445992, AL0120853, AL0349645, AL0874166, AL045620, AL0500061, AL070009, AL033157, AL0254042, AL0702073, AL010402, AW087200, AL0801793, AW022682, AL021773, AW105601, AL081709, AL023670, AL023670.

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HCDMC06	2579	934663	1 - 364	15 - 378	

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HCDMB91	2580	789551	1 - 330	15 - 344	AA297443, AA564510, H01110, AA730795, W96277, AA020873, AA947369, AC005031, AL008719, U80017, AC005015, AC004996, AC002511, AC004655, AC002991, AC002477, AC004253, AC005231, AC002565, AC003665, AC006312, AC005837, AP000556, AL034379, AP000557, AP000552, AC006275, AP000247, AC004216, AC007919, AC005484, AC005529, AC002301, AC005821, AL031673, AC006449, AC000025, Z98742, AP000106, AL034421, AC000379, AC005527, AL049869, AC002404, AC002365, AC005924, AC005102, AC000003, AC016025, AL023807, AC002312, AC005081, AC003950, AL049757, AL109758, Z99774, AC004019, AC004531, AL135744, AC005288, AL022165, AC005071, AC007225, AL022721, AL109628, AL021878, AC002470, AL096701, AL050350, AC000353, AC005736, AF196969, AL021155, AC005730, AF053356, AC004125, AL080243, AC004702, AC000052, AC006121, AC004890, AC007151, AF196779, AC004967, AC005921, AC005520, AF129756, AF111168, AC007688, AC005911, AC002300, AP000514, AC004832, AC004477, AC007055, AC007637, AC002310, AC004098, AL023553, AC004910, AL031255, and AF111167.
HCDMB42	2581	713300	1 - 230	15 - 244	AI525277, and AA079259.
HCDMB41	2582	711996	1 - 563	15 - 577	
HCDMB27	2583	682389	1 - 323	15 - 337	
HCDMB12	2584	968918	1 - 613	15 - 627	AL134524, AI142134, AL038983, AL045328, AL037727, AL042898, AL047163, AL049018, AL038838, AL037343, AL039643, AL037436, AL037335, AL037323, AL037443, AL038532, AL044125, AL047012, AL040193, AL044162, AL037435, AL041347, AL040621, AL043538, AL043496, AL040464, AL038761, AL038822, AL043923, AL043814, AL041238, AL044186, AL040617, AL040463, AL047170, AL043845, AL041324, AL045327, AL044037, AL041635, AL040294, AL041098, AL047219, AL044064, AL041459, AL041577, AL047183, AL040625,

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HCDMB08	2585	958542	1 - 255	15 - 269	AA719107.
HCDMB03	2586	923316	1 - 375	15 - 389	AL119691, AI305766, AW103758, AI284640, AI247199, AA634889, AA679532, AI345681, AI345675, AA584167, AA551552, AI345157, AI344812, AI473475, AW274346, AA747070, AW021207, AW072923, AL043009, AW069769, AI696962, AA515909, AA613203, AA551503, AW419262, AW264934, AI801482, AW265385, AI754336, AW088846, AA167055, AA580808, AI133164, AI334464, AW440345, AI754253, AI469968, AA493975, AL045526, AA683258, AA812281, AW193265, AI345418, AI457397, AW302903, H70994, AI888752, AA478355, AI687343, AA630362, AL038072, AW302013, AA521323, AA490183, AI350211, AW438643, AI872020, AA521399, AI859438, AI334443, N35896, AA303007, AA662225, AA515549, AL138396, AI270117, AA502860, AA483771, AA806796, AI471543, AA083046, AA526787, AW301554, AA831375, AI860013, AL134972, AL038474, AL046409, AW103509, AI634384, AA482768, AW131249, AI262909, AA661921, AW020340, AA220943, AI754658, AW276817, AA525824, AL120775, AA829223, AI554718, AA878438, AA603185, AL037040, AA514854, AW276827, AI698447, AI053672, AA577906, AA533725, AI245679, AI688846, AA459749, AA503258, AA507824, AI254913, AA244357, AA501821, AA722372, AI613280, F27407, AA483936, AA372481, AC006128, AC008372, AL023575, AL023880, X54181, AC006323, U04355, X54180, X55926, U18391, AL031734, U18395, AL132766, U57005, U18394, Z82976, AL035079, U18387, U57009, AC005932, U18398, X55929, U18396, X55927, U57008, AC009509, X55925, AL023284, AC000115, AL021395, U18392, AC005756, X54178, X55931, X54175, X55932, U18388, AC005409, AC005821, U57006, X54179, AC006441, X55933, U18399, AC000353, AL021154, Z85986, AC006077, AL021394, AL021877, U67831, AC004859, L47228, Z99128, AC002312, AC005291, Z82198, AL050306, AC005702, X55922, Z95113, AL109657, AC007386, AC000379, AC005520, U67825, AL109985, X55924, AP000501, AC005251, AC005971, AP000230, AC002300, AL049759, AP000144, AL078593, I51997, AC006045, AL034350, AC006101, AF008191, U40455, AL133243, AP000509, AC005159, AL049830, AC012627, AC004678, AL021546, AC007690, AL050332, AL035414,

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HCDMA20	2587	669201	1 - 331	15 - 345	N62789, N62508, AI289289, N62494, AA936576, R52810, N49008, Z39305, R17666, F02223, H11727, R51380, N93902, and AL119444.
HCBND03	2588	922388	1 - 864	15 - 878	AI702961, AI630765, AW341780, AA931671, AW452292, and U46356.
HCBMZ07	2589	951788	1 - 345	15 - 359	N30431, AA579184, AI791610, AA176605, F19258, AW438916, AA015691, AW265654, AI305766, AW157005, AI028510, AI620585, AI565245, AI783911, AA772016, AA879053, AA992126, H79308, AA904137, W21392, AA128757, AA947837, AA077817, AA657835, AA230143, AA743811, AI090334, AI051037, AI982634, T40612, F29989, AL043098, AA865262, AL039309, AI244254, AI709174, AI358071, AW274197, AI821467, AA054106, AA300061, AI951436, AI499094, F31654, AI358229, AA226584, AW406755, H72688, AI365988, N52796, AA747243, R85717, AW339687, AW069807, AA629702, AI635272, AA743956, AL049610, AC002350, AC009396, AP001138, AF067846, AL049633, Z83819, Z98051, AC002418, AC005412, AL031774, AL031393, Z72521, AP000691, M87914, AC002369, AL031846, AC007304, AC005164, AL033381, AC006160, AC004651, AL109627, AL022313, AP000011, AP000152, AF140763, AL009172, AL021918, AC004904, AC005940, AC001066, AC006254, AC004386, L81893, AC004381, AC004231, AC002425, AC005736, AP000348, AC006539, AP000045, AC007736, AL050333, Z83843, AP000114, AC005971, AP000503, AC008134, L35681, AF001552, AL049856, AL121655, AC004019, AC002316, AC005832, AL133245, AL008731, AC004983, AC007226, AC004882, AC007055, AC005914,

HCBMY10	2590	961718	1 - 478	15 - 492	<p>AC005390, AC007450, AB023052, AL031673, AC002059, AC004388, AL031053, AF148319, AC005578, AC004167, AC009510, AC005003, Z84480, AP000047, AC006409, AP000557, AL109980, AF196779, AC009516, AC003101, AL109628, AL096791, Z83840, AC002558, AL022578, AC004253, AC006381, AF091512, AC006037, Z85987, AC005062, AL021392, AF053356, AC004594, AC005365, AC006077, AL031005, AL096699, AL031391, U91321, AC005796, AL050307, AP000556, AP000513, AP000115, AL031662, AC012099, AF061325, AC005703, AC007514, AC001530, AC005484, AP000356, U14702, AC012384, AC005907, AL022143, AP000308, AP000048, AC004699, AL049745, AC002295, AL080317, AC006552, AC004027, AC003982, AF147277, AC002565, AL033518, AC012627, AL021395, AC006948, AC005838, AC005212, AC006011, AC004087, AL031770, AC000041, AC020663, AL137434, AP000690, AJ003147, AC004678, AL049588, AC007263, AL096701, AC005785, AC004134, AC002487, U63834, AP000502, AP000517, AP000032, AL049694, AL121825, AL109799, AC005837, Z84572, AC004460, AL021878, AC005089, AC004453, Z70289, AC005406, AC008394, AC007676, Z85999, AC006057, AC005972, AC007041, AC004963, AC003037, AC007536, AC007308, AF106656, AC004988, AC004805, AC003954, AC005399, Z85996, AC005366, AC002470, AC005839, Z81369, AC005808, AC004832, AC004263, AB023054, AL049828, AL035422, AC005071, AC005523, and AC006166.</p> <p>T53770, AW069769, AA487272, A1612070, AA582073, AA832175, A1611533, AA760808, AA508359, AL037771, T11828, A1252274, A1732378, AA59241, AA503475, AA527602, AA531079, AA493708, C18840, AA469451, A1133297, AA828802, AA828781, AW021583, AA640685, A1439910, A1270117, AA527727, AW276935, AW023990, A1382825, AL038705, A1561060, A1282479, T29611, AA601642, AA602954, AA809546, AA283730, AL036037, A1687343, A1434695, AA477122, A1754955, AA515905, C18521, A1950671, AA955031, AW021917, AA503258, D82454, AA458703, AA908285, T07039, AW022834, A1933714, AA846935, AA569471, AA548058, A1732151, AA587516, AA502155, D83989, AL135744, X54171, AC008015, AC002091, AC004263, AC005412, X54175, AC004859, AC002302, AC005387, AL022326, M37551, AP000512, AL109798, AC006509, X55926, AL035658, AC004900, U67829, AC005619, AC005399, AC004883, AC004837, AC004893, AC005736, AC006036, AC005971, AL034420, AL031311, AC002352, AC005914, X54178, AC007395, AC004231, Z93241, AP000349, AC006468, AC006023, AC005480, X54181, A1096763, X55933, Z84719, U18399, AL079304, AL022726, AC006115, AC004149, AC004821, X75335, AC005296, U18394, AC004963, AC006285, AC005303, AC007731, AC005500, AC004999, AC000134, U66059, AL031279, AL031680, AC004386, A1034582, AC007199, AC007263, AC006530, AC006539, Z84480, Z83844, U18391, U18395, Z82173, U95743, AP000334, AC007386, AL096776, AC004230, AC005568, AC005184, AC004655, AC005057, AC005484, AL022165, A1239321, AL031683, U18396, AC005368, AC004474, AC007226, AC002312.</p>
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HCBMGI1	2591	965394	1 - 685	15 - 699	AI680459, AI022295, R25336, AI917581, N76313, and AA478089.
HBZSK04	2592	926407	1 - 65	15 - 79	
HBZSG02	2593	920249	1 - 414	15 - 428	AI733802, AI733182, AA948110, and AI261960.
HBZSD32	2594	699335	1 - 415	15 - 429	
HBZAJ73	2595	764479	1 - 489	15 - 503	R84573, R88849, H50890, and X69908.
HBZAJ26	2596	681879	1 - 640	15 - 654	W93922, and AF080623.
HBZAI39	2597	847621	1 - 1325	15 - 1339	T56623, T57310, AI499938, AA601218, AI679782, AI284640, AL043009, AL046409, AI963720, AI334443, AA610491, AW303196, AL079645, AI431303, AW301350, C75026, AW193265, AA630362, AI471534, AI270117, AW406755, AA521323, AA631507, AI471543, AW327868, AA669840, AW274349, AI350211, AW419262, AI860020, AI345681, AI345675, AA394271, AL119691, AI367076, AI912322, AI613280, AI732120, AI206785, AI683577, AI569086, AW243960, AW088846, AI143242, AI469624, AI005388, AL042856, AI312309, AI358229, AI262909, AA680243, AW338086, AA521399, AW131249, AW439558, AW276827, AW408717, AL048925, AI469968, AA584752, AW069481, AI061334, AI471481, AW270270, AA682912, AL042420, AL138455, AI537955, AI561060, AI281881, AA491814, AI371070, AI571512, AA127353, AL042753, AI298710, AI345654, AI937850, AA569471, AI151261, AI619997, AI623898, AI688846, F36273, AI336660, AI085719, AW167267, AI049634, AI053672, AW167372, AW193432, AI365988, AI079910, AI286356, AL044940, AW406162,

AL041706, AA133986, AW407578, AI148277, AL138265, AW023672, AI375710, AL037683, AI110844, AI670124, AI865905, N35896, AI357551, AI954260, AA074130, AI110770, AI754658, AA649642, AI635818, AI282832, AA490183, AW162489, AA714453, AW406659, AI110760, AI434695, AA780515, AI246119, AI287651, AI435544, AI344844, AA350859, AI801591, AI053786, AI043719, AW276817, AI305547, AA226153, AI744995, AI859742, H71429, W79504, AA192740, AW410400, AI951863, AW073470, AL119984, AW247819, AL041690, AI610920, AW276435, AI640702, AW021917, AI888752, AA178953, AI610159, AI279165, AI358343, AI038833, AI761471, F29989, AW339568, AW302013, AA587256, AA713815, AL120687, AI590689, AI590958, AI355224, AI499503, AA226715, U95742, AC007216, AC006948, AC007066, AC007055, AC002115, AC007387, AL022323, Z94721, AP000135, AL023284, AJ003147, AC004463, AC005620, AL022237, AC007664, AL049569, AC005041, AP000031, AC005696, AC002472, AC002375, AC012384, AC005488, AF067844, AC006014, AL034423, Z82244, AC003689, AI049780, AC007242, AC004974, AL031680, AC005104, AC002119, AL031311, AP000044, AP000112, AC005914, AC005971, U47924, AF196779, AC005182, AC010349, AJ246003, AP000112, AC005217, AC003101, AL035417, AC006064, AC007279, AC005527, AC005412, AL121603, Z84488, AC005043, AL121655, AC004000, AC006251, AC005902, Z74617, Y07848, AC006271, AC008009, L78810, AC004967, AL049709, AC002565, AL133382, AC002059, AC005619, AC004125, AL110502, AC004491, AL031075, AC005932, AC005529, AL121658, AF049895, AC004776, AC004686, AC004061, Z68276, AL031668, AC005399, AL021707, AL021546, AC004858, AC000026, AC005356, AL031673, AC015853, AC007011, AC005280, AL022322, AC005786, AC007240, AL133445, AC004963, AC005076, AL132985, AC005300, AC006449, AF002223, AC006019, AC018633, AC007546, AL008715, Z49236, AF135028, AC002316, AC008372, AC005531, AC000025, Z97989, AC006480, AL096791, AC002301, AF217403, AC004526, AC004020, AC005231, AL132712, AC005520, AC004703, AC006030, AC005330, AC008044, AC004841, AL035079, AC005832, AL035685, AP000503, AL031733, AC000159, AC005486, AC005618, AC008115, AC003003, AL133353, Z97054, AL035422, AC004539, AC005291, AC000052, AL133245, Z81450, AC007192, AC004652, AF129756, Z82202, U78027, AC005202, Z86061, AL109798, AL031588, AC004382, AC004585, AC006112, AF109907, AL034429, AC006130, AC004019, AC005015, AC004659, AF107885, AL078477, AC007040, AF165926, AC004876, AC004181, AJ251973, Z85987, AL121652, AL031255, AL021391, AC005740, AC004236, AC004990, AL133371, AC006441, AL022328, AC008014, AC002045, AC005071, AC006160, AC005764, AL008718, AL035072, AC002364, AP000477, AC004816, X60459, AP000297, AP001172, AL035587, AC003678, AC004883, AL031848, AC004030, Y14768, AF134726, AL050306, AL020993, AC002425, AC005784, AC005480, AL031602, AC004217, AC006965, AC005355, AL034452, AP000692, AL009179, AC005057, AC005899, AC008101, AC000072, AC005664,				
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HBZAI14	2598	847620	1 - 512		15 - 526	AA079443.
HBZAB15	2599	660348	1 - 413		15 - 427	
HBZAB08	2600	959560	1 - 449		15 - 463	AI806340, AI347581, AW058265, AI149706, AA858304, AA416860, AA910678, AA470052, AI674598, and AA887474.
HBNBQ50	2601	887096	1 - 604		15 - 618	AA481928, AW370602, AA130551, AA410947, H02520, AA477170, AW362159, AW362184, AI683337, AI151512, AW362163, AW024950, AW362162, AA295138, AW364082, AA434486, AI346658, AI247124, AA434390, AI560635, AI922390, AW193870, AW261977, AI813439, AW050855, AW272323, AI889939, AI633003, AA913117, AI917569, AA862055, AI819001, AA59250, AI589941, AI356811, R72882, AW304202, AI627873, N94336, AA480065, AW130311, AI889450, AW083447, AI631391, AI081435, R93337, AW074375, AW027034, AA527492, W49844, T40555, AI673235, AA010655, H00902, AA211365, AI824358, R66066, AW297543, AA863216, AA568472, AA872583, AA740278, R16077, AW070819, AA877152, AA130587, R72869, AI349088, R72008, AI682945, AI922396, AI682950, AA533970, AA047596, H00901, AA010656, R72471, R15713, R67665, R73357, AI890961, AI801834, AA745829, R73342, AW337286, AW384044, X14856, and A08001.
HBNBQ30	2602	430360	1 - 442		15 - 456	H41301, R36910, AA894644, R87213, H15246, T23507, AI222616, and AB002320.
HBNBL29	2603	703113	1 - 397		15 - 411	R18010, AI680708, and AI635217.
HBNBJ29	2604	907015	1 - 320		15 - 334	AA935421.
HBNBJ06	2605	960664	1 - 284		15 - 298	AI369384, and AA719568.
HBNBB41	2606	712676	1 - 601		15 - 615	H95264, AI680749, AI672415, AI492506, AI633630, AI628076, AA699651, AI090129, N73745, AI434427, AI480111, AW088604, AA988606, AA917930, AA236877, AW300229, AI942393, AI271713, AI627960, AA701995, AI911527, AI693888, AI765976, AA424737, AI984791, AI672498, N38876, AW300532, N66066, W86671, AI478472, AW271444, AI540292, AI350589, AA505970, AA724554, AA905114, AI141611, AA625745, AI623282, AA677788, AI758154, AA553728, AW243369, AI915897, H39811, AI038544, AA904754, F28995, AA953543, H78001, T69270, T67436, H24986, AA235920, Z19235, AI927054, R08315, H81259, T99814, H26910, AI341446, R05488, R05808, C21030, and H39812.
HBNBB27	2607	600905	1 - 130		15 - 144	
HBNBB09	2608	868924	1 - 360		15 - 374	R42401, H17978, AA412292, AA470014, AA632915, AI147693, AI347038, AI308941, AA135185, AA583432, AA836857, AA018749, AA299011, AA528216, AA516435, AA916348, AA514541, N62509, AI350971, AA494556, and AF184971.
HBNBW73	2609	764716	1 - 285		15 - 299	AI190941, R86172, H25501, and Z99289.

HBNAC74	2610	586797	1 - 140	15 - 154	AA318750, AA482345, AA281903, AA305550, AA975640, AW411095, AJ130978, and AF099149.
HBNAC71	2611	525831	1 - 305	15 - 319	
HBNAC48	2612	721983	1 - 338	15 - 352	AA078532, AC006014, AC005488, AC005049, and AL009172.
HBNAC42	2613	714263	1 - 408	15 - 422	AA190822.
HBNAC32	2614	526549	1 - 206	15 - 220	C14348, AI074047, AF007887, AI078283, C14340, N63997, N62637, AI457357, C14382, AI299045, D25956, AW339264, AI347344, AW135793, AI952780, AI337314, AW166959, AL080011, R81679, AW089495, AI440133, AI521589, AA581403, AI634350, AA836392, AI671661, AI281867, AL046227, AW073858, AI832245, AI636588, AL037582, AL037602, AW022682, AI610362, AI817545, AI824746, AI613038, AI583578, AI612913, AI249946, AW023338, AI860897, AW007555, AW161202, AL039730, AI470293, AW087199, AI305745, AI635892, AW132034, AI434969, AI245008, AI628325, AI817373, AI440284, AI289310, AI682891, AI687568, AI432570, AI288285, AW327527, AI538850, AI277008, AI690813, AI285514, AI471898, AI918634, AI933992, AW088944, AI452560, AW265004, AW198112, AW020358, AI491904, AI621341, AI631107, AI699211, AI623941, AL043089, AI954080, AI889148, AL038529, AI587302, AW150308, AI679550, AI678688, AI287446, AW090387, AW058233, AI862135, AL119457, AW264727, AI587156, AI926041, AI005511, AI682968, AI921633, AW166870, AI476109, AI912434, AW411043, AI934011, AI890051, AI446511, N25033, AW085709, AA814990, AI241741, AW167157, AW366372, AI758988, AI783569, AW194014, AI885999, AI922315, AW161098, AW167926, AI635016, AW026905, AI270039, AI862139, AI929108, AI885982, AW089233, AL121041, AI918408, AI696846, AI537076, AI584130, AI469516, AI698391, AI250627, AI623682, AI683634, AI680498, AI961589, AI828568, AI493567, AI963191, AA848053, AI620639, AI589428, AA693314, AA514684, AI933001, AI890391, AI818562, AI683497, AI269580, AW089387, AI624548, AI927233, AA856697, AW084151, AI697372, AW169234, Z98519, AL048644, AI537187, AI828734, AI361701, AI435253, AW079432, AI918554, AI457188, AI609556, AL120987, AA760655, AI499621, AI884459, AW080076, AI701975, AW268122, AI924686, AI687168, AW118414, AI280561, AA768369, AI363957, AI572017, AI783504, AI282669, AW075608, AI922689, AI374987, AI633061, AI554344, AI802542, AI571529, AI702527, AF113694, AL035458, AL021393, AL035587, AC005091, AC004383, AC004987, AL034400, AL031346, AC007358, AL031984, AC004822, AL137705, AC002287, AL049761, AC004797, AC004943, AC005291, Z99297, AC005225, AF042090, AP000697, AL121603, AC007390, AC007172, AP000514, Z82206, AC005876, AC005250, AC002471, AC005374, AC000053, AP000340, Z49258, Z83840, AC006313, L78810, AL049776, AC004470, AC002467, AC006501, AF095901, AC004686, AP000250, AP000133, AP000211, AP000030, AL034417, AC004213, AC002060, Z98949, AL022165, AC004227, AC007384, AC006039, AL009179, Z83844, and AL035407.

HBNA28	2615	525832	1 - 307	15 - 321	AC007539.
HBNA25	2616	525834	1 - 132	15 - 146	
HBNA09	2617	525833	1 - 63	15 - 77	AA604441, A1690219, A1693458, AA508848, AA447094, AA830582, A1703075, AW003969, AW189292, AW014124, AA831149, A1278956, A1922983, AA908927, A1703009, AA455884, A1870286, A1160778, A1873461, A1636871, A1245433, AP000504, and AF129756.
HBNA02	2618	921187	1 - 187	15 - 201	
HBGT76	2619	903653	1 - 819	15 - 833	H62649, AA584581, AA059154, AL043721, AA098922, AA593060, AA443390, AA329321, C18357, C18360, M77895, AA115968, AA365302, AA658235, AW088224, A1921188, AA601270, NA43757, AA634855, A1286356, AL138455, AL043756, AA515224, AW117750, A1357551, A1307201, AA630352, AA084070, A1921649, A1929531, A1064952, A1376100, AW162049, F13749, AA665293, N25303, AA655002, AA641103, AL009179, AL096775, Z70688, AL022324, AL034419, AL022318, AL078581, AC005962, D87717, AL035696, U95742, AL049829, AC007068, AC005664, AC00052, AC004019, AF190465, AC004712, AL023494, AL109627, AL035460, AP000512, AC007022, Z82208, AL122020, AC004797, AC004622, AC006332, AC004477, AL031005, AL008582, AL008721, AC004859, M87923, AC005663, AB023051, AC007686, S42659, AC007225, AC004933, AC005406, AC002287, AC005783, Z95114, AL049776, AL035681, AC006138, AC002119, AC005618, AC004027, AC006596, AL034548, AL049875, AC005358, AC005911, AF111168, AC005725, AC005288, AC007546, AC006576, AP000513, AC004526, AC004671, AF072099, L27148, AC004695, Z82188, AP000270, AC000087, AC004972, AC004927, AP000351, AP000131, AP000209, U66059, AL031848, AC004638, AC000120, AL078477, AL008629, AC016026, AP000248, Z98036, AL031782, AC006480, AL133448, AB016897, AL117258, AL023807, AP000032, AC007690, AC004517, AL031296, AC005324, AC005696, AC006211, AP000349, AC007845, AC005081, AL022163, AC004035, AL034420, AC005362, AP000049, Z82178, AP000134, AP000212, AL031291, AP000311, AC007283, AC005808, AL023553, AL031591, AP000080, AL031846, AC006409, AL109628, AC004522, AC007676, AC004890, AC005104, Z85996, AC002115, AL022311, AC006132, AF165926, Z97205, AC006285, AC005342, and AF196969.
HBGTE11	2620	965121	1 - 313	15 - 327	AW015800, AA251013, and AF037222.
HBGQS88	2621	886650	1 - 436	15 - 450	AW304683, and AC004152.
HBGNL85	2622	848179	1 - 692	15 - 706	AW104050, AA738352, A1953035, A1341184, AA995803, and AA911220.
HBGND04	2623	926973	1 - 582	15 - 596	A1057634, AW182951, A1655334, AA854636, A1218588, A1457916, AA961245, and AA953084.
HBGMT82	2624	954374	1 - 495	15 - 509	AW007399, AA782657, A1673493, AW104963, A1539419, A1970048, AW272491, A1827847, A1707847, A1201450, A1160580, A1149344, A1719374, A1870582, AW068652, AW131835, AA022523, A1142042, AA689495, A1394166, A1197831, A1452812, AA536006, AA483525, N24911, A1220974, AA994188, AA687451, AA745895, A1808412, A1475847, AA687509,

HBGMS69	2625	754392	1 - 438	15 - 452	AA733114, AA480131, N78953, AA380438, AW246627, A1749023, A1382254, AA524482, F22287, AA053148, AA689552, AA405870, A1190107, W17347, A1245397, AA482098, AA622680, A1458806, A1143698, AW084279, AA113160, AW304748, AA977756, A1589259, A1917965, A1061434, AA576098, AF096303, and AF024631.
HBGMO78	2626	773043	1 - 474	15 - 488	N78741.
HBGMG81	2627	880276	1 - 678	15 - 692	AA417275, AA421555, A1863143, AA460243, A1491842, A1540501, AA831948, A1082645, A1969655, A1864102, A1355990, A1923989, A1564629, AL036705, A1924051, AA642437, AA804776, A1567883, AF070643, U02475, A1137258, and A1137254. AA974503, A1986165, AL079812, AA287570, AA255853, A1129446, AL043009, AA866015, AW237905, AA653154, AF039185, A1755214, H96249, A1754105, A1754567, A1656840, AL079734, A1476049, AA488903, H07953, AA521399, AA521323, A1369580, AA013168, AA054085, A1380617, AW419389, AW265385, T74524, AA019973, AW069769, A110844, AA443390, AL043718, A1431303, AA442528, A1358712, AW419262, A167792, AA489204, AA613203, A1733856, AA833875, AW023111, AA833896, AA826669, AA491284, A1675615, A1821714, A1792133, A1791913, AA665330, A1815210, A1612142, A1609972, AW271904, A1150401, A1923052, AA769402, AW327868, AW003886, A1118991, R43310, A1119838, AW245747, A1436433, AA719073, AA191418, AA847499, AA682912, A1917132, A1247101, A1792521, AA410788, AA613232, AW021917, AA630362, A1582769, AA563733, A1247101, A1821785, A1732151, A1583252, AW303196, A1687343, A1610941, AL044940, AA480772, A1003972, AA502532, AW026305, A1421950, A1345654, AA669840, AA530958, AW408717, AW270385, A1419337, AW270771, A1963720, AW193265, A1754653, A1056177, AA613227, AA829036, AW020088, AW301350, AA659324, AA581903, H73550, AW265688, AW020150, AL046205, AL042756, AL038705, AA569667, AA714110, AA579179, AA128592, A1345157, AA714011, A1270117, AA468022, AA631507, A1879951, AC007349, AC004913, AL023803, AP000088, AL121603, U85195, AC005291, AC005527, AC007687, AP000557, AE000658, AC005529, AC005694, AC000052, AC007488, AL078593, AL021155, AP000355, AC000025, AL132712, AC005411, AJ010770, AC004167, AP000501, AF088219, AC004686, AP000503, AL008627, AL031255, AC000353, AC004019, AC004638, AL078463, AC005355, AC002369, AL096774, AC005225, U96629, AC006480, AC004812, AC020663, AL021918, AL133448, AP000505, U91319, AL031659, AC004228, AL133243, AC007536, AC002350, AC002565, AC002347, AC002045, AC006965, AC006285, AC006064, AC005015, AL035089, AP000044, AP000112, AL009181, AC005274, AC006211, AL008718, AF196779, AL023807, AC008040, AF045555, AP000114, AP000046, AL022323, AC005778, AC005488, AC005531, AC004941, AL121652, AC002470, AL031311, AC006126, AC005799, AL035072, AL022326, AL034549, AP001051, AC005859, AL022322, AC007664, AL031668, AC003684, AC005899, Z95152, AL031283, AC007225, AC006449, AL050318, AL121655, AC005996, AC005318, AC005378,

					U80017, AC005231, AC003101, AC005900, U95742, AL031848, AC006511, L78833, Y14768, Z99716, Z81314, AC002395, AC002316, AF139813, AC002314, AC005295, AL109628, AC005086, AC005701, AC007216, AC006388, AC007308, AC006000, AF001549, AC005519, AC005988, AC005837, AC005756, AC002549, AL023553, AC006111, AC002301, AC004815, AC005207, D88270, AP000245, AC005031, AC005747, AC005088, AC011311, AF030453, AC007731, AC007666, AJ246003, AC007686, AC007384, AL133244, AC002310, AC009247, AC007919, AC007227, AC006130, AC005914, AL078623, AC004797, AC005911, AC005280, AC007395, AL021707, AC005500, Z99128, AC005324, AC007546, AL031427, AL049759, AL034420, AC009516, AC005562, AC006057, AC004526, AC003029, AL050341, AL049748, AC005154, AL096791, AC006213, AC005250, AL049869, AF129756, Z83838, AC002504, AL020997, AC006312, AC004675, U62317, AC006277, AC005399, AC006468, AL109865, AL031662, AL021368, AC004990, AL109827, AP000031, AC002429, AL035417, AC003983, AL024474, AC005206, AC005393, AC003080, AC004878, AC004805, AL035455, U47924, AC007262, AP000504, AC005874, AF134471, AC006252, AC004020, Y07848, AC003006, U91321, AC006023, AC005412, AC005043, AL022312, AC004106, AC004883, AP000692, AC006236, Z98742, AC004659, AC000026, AC007066, AC005783, AC007637, AL035681, Z83844, AL050312, AC007450, AC005184, AC007242, AC005696, AL109984, AC005484, AC007993, AP001037, AC005520, AL121653, AC005011, AC004033, AC005667, AC004584, AC004988, AL121658, AP000553, AL031670, AC006430, and Z85986.
HBGFS88	2628	914032	1 - 628	15 - 642	AA778429, AI563955, AA928041, AA626794, AI871136, W44486, AA071274, AA126250, AA902119, AA029458, AI814680, N70230, AI340231, N67040, AW074273, AI417119, AI027942, AI343619, AA644262, AI080252, AI804089, AA865354, AI186469, AA496355, AI753118, AI868721, N63928, N71035, AI336036, AA861853, AW262673, AA205643, D60248, AI524080, AI969141, AI755095, AW249740, AI955645, D60466, C00015, N98454, AA496405, D60550, AI659597, AI383091, N79606, AI187029, AA128493, D60009, AA512988, AA128352, H94297, AA626779, AI357512, H95828, C14688, T70086, AA649543, AA595243, AI368586, AW022016, T47633, AI672897, AA029523, R73069, AA693672, AA991733, R94710, T83736, AI418701, AW028373, R23240, AI538371, AI954235, AI623761, D81788, AA205642, W01019, AI954237, H94191, AI382863, R33837, AA364340, AA094118, R94790, D81287, W44485, R23316, W19084, N41706, D60973, T70157, R81247, T83907, AI910652, D60249, D81466, AA093704, D60551, AA354560, R33836, R81248, W01933, AI683085, AA383533, T47632, AA093663, H57883, AI355051, and AC005369.
HBGFG53	2629	727748	1 - 461	15 - 475	AA419551, AW292148, AI791628, AI821482, and AL137722.
HBGDH33	2630	702854	1 - 458	15 - 472	AI399653, AA453794, R44976, H06251, R60067, AI278851, AA528243, AA973793, AA453879, R44717, and Z40655.
HBGDF39	2631	861602	1 - 341	15 - 355	D59582, and D59820.

HBGDA74	2632	832888	1 - 474	15 - 488	AI565755, AI342368, W76561, AA780301, AI200880, AW195697, AA451937, W23209, AA364898, AI050849, H39591, AI028147, AW293972, AI474504, AA324713, AI628717, AA961641, N24530, AF071749, AF136279, AF071748, AF132894, AF088886, AR016587, AL137742, AJ007331, and E15813.
HBGBG69	2633	802090	1 - 43	15 - 57	R60478, R11939, AI140927, AW166520, AI097082, AI378818, AW070736, AA022937, AI417973, AI278239, AA813598, AW024249, AI143513, R02801, AW024258, AI097158, AI217615, AA128646, AI831140, AA151765, AI348969, AW058275, AI273856, AI537960, AI310767, AA012905, AL048340, AI952433, AI348854, N22406, AI335235, N20984, AA808904, AI860833, R49697, AI673140, AI810317, AW075382, AL047422, AI288076, AI499104, AI539690, AI473554, AL117403, AF115410, U58996, U68233, I92592, AC005902, AR068751, AF100781, AF213396, Y10080, AL117583, AC004227, AC006288, AF013249, AL133081, AF026124, AF181849, AF181850, AI5345, AL080124, AC005221, AR066486, A70386, AF161699, AF082526, AL049300, I80064, D44497, I08608, AF000301, AF137367, AR023871, AL050310, X56530, and AL110222.
HBGBG52	2635	522424	1 - 245	15 - 259	T71030, AA747777, AA381858, AA668902, AA558060, T90248, AA934680, AA059235, T70174, AA678436, H86264, AC006001, AC002350, AL021546, AC006449, AC006026, AC003102, AC004895, U18671, AC005387, AL133246, AC022517, AC005696, AL021939, AL035072, AC005089, AC005694, AL050333, AC005565, AL121603, AL135744, AC005839, AL008582, AC006960, U95742, AC006277, AC006071, AL022302, AC006241, AL031681, AC005295, AC005004, AC005899, AC002312, AC005785, AL049776, AC002310, AC004253, AC007666, AC006530, AC004859, AC000353, AJ003147, AC004858, AC005081, AC002126, AF196969, AC005231, AC004966, AL035587, AF109907, AC002470, AC005015, AP000688, AC005829, AC004383, AC005529, AC005940, AC004491, AL022322, AC007216, AC004019, AC006064, AC004030, AC007055, AL034420, AC005288, Z83840, D00591, AC007308, AL023803, AC005011, AL049757, AC005776, AC005102, AC007021, AL034423, AP000692, AL109847, AF017104, AP000503, AC002347, AL035659, S77605, Z99716, AP000556, AL031005, AC002369, AL079340, AC007917, AL049780, AC004228, AC005944, AC005971, AC004770, AC004804, AC006312, Z98950, AC002128, AC005527, AC002073, U91326, AC007193, AC002116, AL008718, AC007421, AC002477, AC007637, AF001549, AC002072, AF003626, AC005218, AL121655, AC005500, AL035071, AC003689, AC005622, AL022318, AL050318, AB003151, AL096707, D26535, AL096701, AL022323, AL034350, AC005535, AC004876, Z83820, AC007066, AC007283, AP000115, AL133371, L78810, AC009516, and AC002316.
HBGBG38	2636	525837	1 - 137	15 - 151	
HBGBE12	2637	971466	1 - 94	15 - 108	

HGBB78	2638	773930	1 - 329	15 - 343	H51141, and D37934.
HBCPV80	2639	932817	1 - 390	15 - 404	AI306162, AI492835, AC002359, and AC002365.
HBCPO75	2640	927520	1 - 473	15 - 487	AI017490, AI221329, AA973064, AA813611, AI688144, AI222206, AW182987, AA883877, W31185, AI208514, AI917508, and AI810095.
HBCPK03	2641	922493	1 - 720	15 - 734	AA831288.
HBCJP02	2642	917981	1 - 494	15 - 508	AI188098, AW304309, AI375434, AI625524, AI016723, AI167974, AI302664, AW001092, AI246687, AI572643, AI201622, AW151711, AW167729, AI609516, AI687735, AI191064, AI289182, AI191358, AI024836, AA632308, AI831665, AI084459, AI088322, AA242818, AA580006, AI888580, AA011305, AI870130, AW168685, AA010915, AW078807, AI372084, AI217609, AI200991, AW237859, AI263564, AA629134, AI720347, AA862783, AI880912, AA564376, AI879913, AI367291, N74110, Z21520, AA028965, AI349340, AA298576, and AI582057.
HBCJG07	2643	951898	1 - 375	15 - 389	R82747, R30969, and T87286.
HAUCC58	2644	764851	1 - 390	15 - 404	AA235095, W63805, W07740, AA302624, AA293831, AA315199, R53208, AI568567, AI992241, AI086596, AW151172, AA309877, AI080304, AA401651, AW090277, AA150647, AA708776, AA142944, AI826693, AA843315, N77987, AW051448, AA527053, N92512, R87425, AI129519, AI031868, AI083531, AI335895, AI039605, AI299184, AI200329, AI148099, AA788733, AA115544, AA389673, AW337779, AA588191, AI141373, H66602, AI192219, AA708520, AA079352, AI076910, AA872411, AA860813, AI160688, AI805893, AA455203, AA769806, AA411491, AA436345, AA493343, AI193844, AI421247, AI167692, AI074899, AI193867, AA249309, F32557, AA722032, N80680, W38964, F24549, T83037, AA402479, AA844466, AI141356, N58395, AA454862, AI161139, AW008542, W93969, W93970, AA336147, R48412, AI378335, T90357, H95941, AA568295, R86694, AA341105, AA228455, AW352337, W30921, AW337638, N74117, AA303783, AA215973, AW009811, R53110, AA558040, AI961636, F24945, AA715148, R49774, F35088, AA228454, AA328964, AA077962, R11503, H87636, AI695590, AA904185, AA398459, AI803601, R86695, AA115055, AA192729, AA889647, and AF151893.
HAUAW51	2645	577959	1 - 336	15 - 350	AA214667, and H78996.
HAUAS89	2646	518847	1 - 164	15 - 178	AA926970, F27522, F30071, AA096277, AA627396, F33364, AA318284, AI283651, F27676, AW015956, AA947143, AA244132, AA327732, AA352731, AA320725, AA089891, AA317435, AA319168, F30100, AA664996, F29754, F27644, F27760, AI832645, F24555, AI560279, AA306681, AI749712, AI289147, AI130748, AA694164, AI023676, AA244131, F26815, AI039009, F33405, AI309287, AA534561, T74859, F35771, F34894, F35313, W78719, F30920, AA694524, AA524049, AI150756, AI344732, D51606, AA903996, AA864997, AC008044, and AC008372.
HAUAQ28	2647	685374	1 - 520	15 - 534	AA127594.

HAQCF25	2648	678235	1 - 513	15 - 527	T63571, AI832218, T63496, AI004915, AI990727, AW381879, AW381818, AW381815, AI254648, AI917020, and AL137725.
HAQCD07	2649	958959	1 - 439	15 - 453	AI142585, AI082139, AW051999, AA833602, AA719280, AA703255, AI870257, AI952791, AA625853, AI125671, AW104742, AA813022, R44512, AA928937, AI826007, AI921451, AI272168, AL120554, AI928736, R48258, AI453416, AW104741, AI933170, AA350537, T98866, AA364915, T40772, AI784134, AA053022, AA740797, AA350621, AA340417, AI240679, AA308837, H16246, AA053159, AA907088, N86840, AW401390, AI939391, AW071136, H30533, R37449, R37338, AC005781, and AC005581.
HACMR08	2650	955638	1 - 485	15 - 499	AI292236, AW265393, AI123080, AW069769, AL042373, AW069227, AL038936, AI040051, AW438542, AI216990, AL079734, AA402129, AI887235, AI674946, AA501461, AI733856, AI755214, AW303196, AA469327, AA502532, AW301350, AL120343, AI754105, AA515728, AI754567, AW274349, AI821714, AI792133, AI791913, AW265090, AW270258, AW088846, AW021015, AW237905, AW072923, AW302315, AI354423, AW103509, AW341903, AI859946, AI821785, AA653139, AW270270, AL040054, AA613627, AI696962, AI357823, AL042856, AW407578, AA602906, AI801482, AI267356, AW270619, T67090, AI753488, AI281881, AA582554, AW021917, AA634837, AA715814, AI267450, AI874341, AA704393, AL045709, T74524, AA644090, AI754037, AA584489, AI969436, AA631507, AI282253, AI054333, AW410354, AW277174, AA470344, AA533025, AW117740, AL044858, AA284247, AA595499, AI473943, AI278089, AW302711, AW270768, AA764783, AI889440, AI275982, AI687343, AI081147, AL042756, AI368256, AW190505, AI291037, AW327624, H07953, AI244127, AW263864, AI371249, AA525253, AA613624, AW438539, AI792499, AI017251, AA833875, AA833896, AA192278, AI144081, AI380617, AI369580, AI567076, AL079645, AI291823, AA430137, AI110844, AA634786, AW020992, AI064864, AW021951, AA307598, AW021154, AI917132, AA622801, H73561, AI872216, AI109758, AC002301, AC006077, Z68276, AC005089, AL049872, AC006441, Z82182, AC002306, AC007204, AF205588, AP000251, AC005399, AC006262, AP000212, AP000134, AP000030, AC007371, AC002430, AC005808, AC007384, AC004859, AC006006, AC005632, AP000356, AL022721, AC004257, AC005037, AF053356, AL034417, AC005696, AC002119, AC005261, AL034420, AF196779, AC004815, AC004797, AF111167, AC004878, Z85986, AC005377, AC004253, AC002477, AC005901, AC005519, AC004655, AC002492, AL031433, AL035458, AC006317, AC006966, AC004921, AC004895, AC004477, AL022476, AL133448, AC004858, AC005682, AB023049, AC005060, AC000113, AC005179, AF196972, AC005666, AC008372, AC007055, AL135744, AP000065, AC004967, AL024509, AC007216, AC015853, AC002425, AF109907, AL034429, AC002544, AL121658, AC007684, AC007842, AC002347, AC004106, AC007227, AC006487, AC005332, AC005251, AL031228, AC007226, AC007686, AL136504, AF031078, AC004972, AL079340, AC006430, AL033527, AC005701, AF015262, AF165142, AL050307, AC005694,

AL035410, U85195, AL008627, AF030876, AC005200, AJ229043, AC002039, AC005829, AC004098, AC009247, Z98200, AC004686, AL139054, AC004128, AL021918, AC004099, AC004386, AC003101, AC004552, AC005599, AE000658, AF042090, Z84467, AC003093, AC004448, AC007073, AL033525, AC005255, AC004890, AC005324, AC005578, AL031005, AC007225, AF111168, AC005726, AC005821, AL035587, AC005207, AC004408, AL022327, AC005529, U95742, AC006026, AC004236, AC004150, AC005736, AC007052, AF134726, AC000353, AC003108, AF088219, AL022320, AF129756, Z82244, AP000215, AC004263, AC016831, AC008115, AF146191, AC004659, AL035405, AL021393, AC005899, AC002365, AF001549, AC006101, AL021546, AL117344, Z97056, AL133246, AL034548, Y18000, AC003992, AC004707, AF017104, AD000092, AC007899, AC012627, AC005905, AC004590, AP000505, AC005874, AF134471, AC004796, AL031117, AL109627, AL049643, AL049748, AC005972, AL049873, AP000252, AL133500, AC004913, AL034555, AC006120, D87675, AL135960, AJ131016, AC007277, AC005378, AC005071, AC003070, AC004841, AC004622, Z97352, AC002350, AC006254, AC006511, Z98742, AL031276, AC003110, D63507, AL096701, AC005216, AC004475, AP000349, Z70288, AL031286, AC005409, AC002073, Y10196, AC005520, AC005057, AF064861, AL049843, AC005102, AC004812, AC002418, AC005295, AC002553, AL110502, AF190465, AL121603, AC000385, AC007546, AL022162, AC005730, AC005484, AC004887, AC004000, AL122023, AC005280, AC003043, AC002504, AL031295, AC007537, Z68269, AF015148, AC008044, AB026898, AL109628, and AL420248.					
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TABLE 4

Code	Description	Tissue	Organ	Cell Line	Disease	Vector
AR022	a Heart	a Heart				
AR023	a Liver	a Liver				
AR024	a mammary gland	a mammary gland				
AR025	a Prostate	a Prostate				
AR026	a small intestine	a small intestine				
AR027	a Stomach	a Stomach				
AR028	Blood B cells	Blood B cells				
AR029	Blood B cells activated	Blood B cells activated				
AR030	Blood B cells resting	Blood B cells resting				
AR031	Blood T cells activated	Blood T cells activated				
AR032	Blood T cells resting	Blood T cells resting				
AR033	brain	brain				
AR034	breast	breast				
AR035	breast cancer	breast cancer				
AR036	Cell Line CAOv3	Cell Line CAOv3				
AR037	cell line PA-1	cell line PA-1				
AR038	cell line transformed	cell line transformed				
AR039	colon	colon				
AR040	colon (9808co65R)	colon (9808co65R)				
AR041	colon (9809co15)	colon (9809co15)				
AR042	colon cancer	colon cancer				
AR043	colon cancer (9808co64R)	colon cancer (9808co64R)				
AR044	colon cancer 9809co14	colon cancer 9809co14				
AR045	corn clone 5	corn clone 5				
AR046	corn clone 6	corn clone 6				
AR047	corn clone2	corn clone2				
AR048	corn clone3	corn clone3				
AR049	Corn Clone4	Corn Clone4				
AR050	Donor II B Cells 24hrs	Donor II B Cells 24hrs				
AR051	Donor II B Cells 72hrs	Donor II B Cells 72hrs				
AR052	Donor II B-Cells 24 hrs.	Donor II B-Cells 24 hrs.				
AR053	Donor II B-Cells 72hrs	Donor II B-Cells 72hrs				
AR054	Donor II Resting B Cells	Donor II Resting B Cells				
AR055	Heart	Heart				
AR056	Human Lung (clontech)	Human Lung (clontech)				
AR057	Human Mammary (clontech)	Human Mammary (clontech)				
AR058	Human Thymus (clontech)	Human Thymus (clontech)				
AR059	Jurkat (unstimulated)	Jurkat (unstimulated)				
AR060	Kidney	Kidney				
AR061	Liver	Liver				
AR062	Liver (Clontech)	Liver (Clontech)				
AR063	Lymphocytes chronic lymphocytic leukaemia	Lymphocytes chronic lymphocytic				

		leukaemia				
AR064	Lymphocytes diffuse large B cell lymphoma	Lymphocytes diffuse large B cell lymphoma				
AR065	Lymphocytes follicular lymphoma	Lymphocytes follicular lymphoma				
AR066	normal breast	normal breast				
AR067	Normal Ovarian (4004901)	Normal Ovarian (4004901)				
AR068	Normal Ovary 9508G045	Normal Ovary 9508G045				
AR069	Normal Ovary 9701G208	Normal Ovary 9701G208				
AR070	Normal Ovary 9806G005	Normal Ovary 9806G005				
AR071	Ovarian Cancer	Ovarian Cancer				
AR072	Ovarian Cancer (9702G001)	Ovarian Cancer (9702G001)				
AR073	Ovarian Cancer (9707G029)	Ovarian Cancer (9707G029)				
AR074	Ovarian Cancer (9804G011)	Ovarian Cancer (9804G011)				
AR075	Ovarian Cancer (9806G019)	Ovarian Cancer (9806G019)				
AR076	Ovarian Cancer (9807G017)	Ovarian Cancer (9807G017)				
AR077	Ovarian Cancer (9809G001)	Ovarian Cancer (9809G001)				
AR078	ovarian cancer 15799	ovarian cancer 15799				
AR079	Ovarian Cancer 17717A1D	Ovarian Cancer 17717A1D				
AR080	Ovarian Cancer 4004664B1	Ovarian Cancer 4004664B1				
AR081	Ovarian Cancer 4005315A1	Ovarian Cancer 4005315A1				
AR082	ovarian cancer 94127303	ovarian cancer 94127303				
AR083	Ovarian Cancer 96069304	Ovarian Cancer 96069304				
AR084	Ovarian Cancer 9707G029	Ovarian Cancer 9707G029				
AR085	Ovarian Cancer 9807G045	Ovarian Cancer 9807G045				
AR086	ovarian cancer 9809G001	ovarian cancer 9809G001				
AR087	Ovarian Cancer 9905C032RC	Ovarian Cancer 9905C032RC				
AR088	Ovarian cancer 9907 C00 3rd	Ovarian cancer 9907 C00 3rd				
AR089	Prostate	Prostate				
AR090	Prostate (clonotech)	Prostate (clonotech)				
AR091	prostate cancer	prostate cancer				
AR092	prostate cancer #15176	prostate cancer #15176				
AR093	prostate cancer #15509	prostate cancer #15509				
AR094	prostate cancer #15673	prostate cancer #15673				
AR095	Small Intestine (Clontech)	Small Intestine (Clontech)				

AR096	Spleen	Spleen				
AR097	Thymus T cells activated	Thymus T cells activated				
AR098	Thymus T cells resting	Thymus T cells resting				
AR099	Tonsil	Tonsil				
AR100	Tonsil germinal center centroblast	Tonsil germinal center centroblast				
AR101	Tonsil germinal center B cell	Tonsil germinal center B cell				
AR102	Tonsil lymph node	Tonsil lymph node				
AR103	Tonsil memory B cell	Tonsil memory B cell				
AR104	Whole Brain	Whole Brain				
AR105	Xenograft ES-2	Xenograft ES-2				
AR106	Xenograft SW626	Xenograft SW626				
H0008	Whole 6 Week Old Embryo					Uni-ZAP XR
H0009	Human Fetal Brain					Uni-ZAP XR
H0012	Human Fetal Kidney	Human Fetal Kidney	Kidney			Uni-ZAP XR
H0013	Human 8 Week Whole Embryo	Human 8 Week Old Embryo	Embryo			Uni-ZAP XR
H0028	Human Old Ovary	Human Old Ovary	Ovary			pBluescript
H0030	Human Placenta					Uni-ZAP XR
H0031	Human Placenta	Human Placenta	Placenta			Uni-ZAP XR
H0032	Human Prostate	Human Prostate	Prostate			Uni-ZAP XR
H0038	Human Testes	Human Testes	Testis			Uni-ZAP XR
H0040	Human Testes Tumor	Human Testes Tumor	Testis		disease	Uni-ZAP XR
H0046	Human Endometrial Tumor	Human Endometrial Tumor	Uterus		disease	Uni-ZAP XR
H0050	Human Fetal Heart	Human Fetal Heart	Heart			Uni-ZAP XR
H0051	Human Hippocampus	Human Hippocampus	Brain			Uni-ZAP XR
H0052	Human Cerebellum	Human Cerebellum	Brain			Uni-ZAP XR
H0055	Human Umbilical Vein	Human Umbilical Vein Endothelial Cells	Umbilical vein			Uni-ZAP XR
H0056	Human Umbilical Vein, Endo. remake	Human Umbilical Vein Endothelial Cells	Umbilical vein			Uni-ZAP XR
H0057	Human Fetal Spleen					Uni-ZAP XR
H0059	Human Uterine Cancer	Human Uterine Cancer	Uterus		disease	Lambda ZAP II
H0063	Human Thymus	Human Thymus	Thymus			Uni-ZAP XR
H0087	Human Thymus	Human Thymus				pBluescript
H0090	Human T-Cell Lymphoma	T-Cell Lymphoma	T-Cell		disease	Uni-ZAP XR
H0102	Human Whole 6 Week Old Embryo (II), subt	Human Whole Six Week Old Embryo	Embryo			pBluescript
H0111	Human Placenta, subtracted	Human Placenta	Placenta			pBluescript
H0124	Human Rhabdomyosarcoma	Human Rhabdomyosarcoma	Sk Muscle		disease	Uni-ZAP XR
H0144	Nine Week Old Early Stage Human	9 Wk Old Early Stage Human	Embryo			Uni-ZAP XR
H0150	Human Epididymus	Epididymis	Testis			Uni-ZAP XR
H0156	Human Adrenal Gland Tumor	Human Adrenal Gland Tumor	Adrenal Gland		disease	Uni-ZAP XR
H0163	Human Synovium	Human Synovium	Synovium			Uni-ZAP XR
H0165	Human Prostate Cancer, Stage B2	Human Prostate Cancer, stage B2	Prostate		disease	Uni-ZAP XR

H0166	Human Prostate Cancer, Stage B2 fraction	Human Prostate Cancer, stage B2	Prostate		disease	Uni-ZAP XR
H0168	Human Prostate Cancer, Stage C	Human Prostate Cancer, stage C	Prostate		disease	Uni-ZAP XR
H0169	Human Prostate Cancer, Stage C fraction	Human Prostate Cancer, stage C	Prostate		disease	Uni-ZAP XR
H0170	12 Week Old Early Stage Human	Twelve Week Old Early Stage Human	Embryo			Uni-ZAP XR
H0171	12 Week Old Early Stage Human, II	Twelve Week Old Early Stage Human	Embryo			Uni-ZAP XR
H0176	CAMA1Ee Cell Line	CAMA1Ee Cell Line	Breast	Cell Line		Uni-ZAP XR
H0178	Human Fetal Brain	Human Fetal Brain	Brain			Uni-ZAP XR
H0179	Human Neutrophil	Human Neutrophil	Blood	Cell Line		Uni-ZAP XR
H0181	Human Primary Breast Cancer	Human Primary Breast Cancer	Breast		disease	Uni-ZAP XR
H0182	Human Primary Breast Cancer	Human Primary Breast Cancer	Breast		disease	Uni-ZAP XR
H0188	Human Normal Breast	Human Normal Breast	Breast			Uni-ZAP XR
H0194	Human Cerebellum, subtracted	Human Cerebellum	Brain			pBluescript
H0196	Human Cardiomyopathy, subtracted	Human Cardiomyopathy	Heart			Uni-ZAP XR
H0211	Human Prostate, differential expression	Human Prostate	Prostate			pBluescript
H0212	Human Prostate, subtracted	Human Prostate	Prostate			pBluescript
H0244	Human 8 Week Whole Embryo, subtracted	Human 8 Week Old Embryo	Embryo			Uni-ZAP XR
H0252	Human Osteosarcoma	Human Osteosarcoma	Bone		disease	Uni-ZAP XR
H0253	Human adult testis, large inserts	Human Adult Testis	Testis			Uni-ZAP XR
H0255	breast lymph node CDNA library	Breast Lymph Node	Lymph Node			Lambda ZAP II
H0263	human colon cancer	Human Colon Cancer	Colon		disease	Lambda ZAP II
H0266	Human Microvascular Endothelial Cells, fract. A	HMEC	Vein	Cell Line		Lambda ZAP II
H0270	HPAS (human pancreas, subtracted)	Human Pancreas	Pancreas			Uni-ZAP XR
H0271	Human Neutrophil, Activated	Human Neutrophil - Activated	Blood	Cell Line		Uni-ZAP XR
H0294	Amniotic Cells - TNF induced	Amniotic Cells - TNF induced	Placenta	Cell Line		Uni-ZAP XR
H0295	Amniotic Cells - Primary Culture	Amniotic Cells - Primary Culture	Placenta	Cell Line		Uni-ZAP XR
H0310	human caudate nucleus	Brain	Brain			Uni-ZAP XR
H0316	HUMAN STOMACH	Human Stomach	Stomach			Uni-ZAP XR
H0328	human ovarian cancer	Ovarian Cancer	Ovary		disease	Uni-ZAP XR
H0341	Bone Marrow Cell Line (RS4;11)	Bone Marrow Cell Line RS4;11	Bone Marrow	Cell Line		Uni-ZAP XR
H0369	H. Atrophic Endometrium	Atrophic Endometrium and myometrium				Uni-ZAP XR
H0372	Human Testes	Human Testes	Testis			pCMVSPORT 1
H0373	Human Heart	Human Adult Heart	Heart			pCMVSPORT 1

H0383	Human Prostate BPH, re-excision	Human Prostate BPH				Uni-ZAP XR
H0392	H. Meningioma, M1	Human Meningioma	brain			pSport I
H0399	Human Kidney Cortex, re-rescue	Human Kidney Cortex				Lambda ZAP II
H0411	H Female Bladder, Adult	Human Female Adult Bladder	Bladder			pSport I
H0412	Human umbilical vein endothelial cells, IL-4 induced	HUVE Cells	Umbilical vein	Cell Line		pSport I
H0414	Ovarian Tumor I, OV5232	Ovarian Tumor, OV5232	Ovary		disease	pSport I
H0415	H. Ovarian Tumor, II, OV5232	Ovarian Tumor, OV5232	Ovary		disease	pCMVSPORT 2.0
H0427	Human Adipose	Human Adipose, left hiplipoma				pSport I
H0428	Human Ovary	Human Ovary Tumor	Ovary			pSport I
H0431	H. Kidney Medulla, re-excision	Kidney medulla	Kidney			pBluescript
H0435	Ovarian Tumor 10-3-95	Ovarian Tumor, OV350721	Ovary			pCMVSPORT 2.0
H0436	Resting T-Cell Library, II	T-Cells	Blood	Cell Line		pSport I
H0478	Salivary Gland, Lib 2	Human Salivary Gland	Salivary gland			pSport I
H0483	Breast Cancer cell line, MDA 36	Breast Cancer Cell line, MDA 36				pSport I
H0484	Breast Cancer Cell line, angiogenic	Breast Cancer Cell line, Angiogenic, 36T3				pSport I
H0486	Hodgkin's Lymphoma II	Hodgkin's Lymphoma II			disease	pCMVSPORT 2.0
H0494	Keratinocyte	Keratinocyte				pCMVSPORT 2.0
H0520	NTERA2 + retinoic acid, 14 days	NTERA2, Teratocarcinoma cell line				pSport I
H0521	Primary Dendritic Cells, lib 1	Primary Dendritic cells				pCMVSPORT 3.0
H0533	Human Stromal endometrial fibroblasts, treated w/ estradiol	Human Stromal endometrial fibroblasts, treated w/				pSport I
H0534	Human Stromal endometrial fibroblasts, treated with progesterone	Human Stromal endometrial fibroblasts, treated w/				pSport I
H0539	Pancreas Islet Cell Tumor	Pancreas Islet Cell Tumour	Pancreas		disease	pSport I
H0543	T cell helper II	Helper T cell				pCMVSPORT 3.0
H0544	Human endometrial stromal cells	Human endometrial stromal cells				pCMVSPORT 3.0
H0545	Human endometrial stromal cells-treated with progesterone	Human endometrial stromal cells-treated with proge				pCMVSPORT 3.0
H0546	Human endometrial stromal cells-treated with estradiol	Human endometrial stromal cells-treated with estra				pCMVSPORT 3.0
H0547	NTERA2 teratocarcinoma cell line+retinoic acid (14 days)	NTERA2, Teratocarcinoma cell line				pSport I

H0549	H. Epididymus, caput & corpus	Human Epididymus, caput and corpus				Uni-ZAP XR
H0550	H. Epididymus, cauda	Human Epididymus, cauda				Uni-ZAP XR
H0551	Human Thymus Stromal Cells	Human Thymus Stromal Cells				pCMVSPORT 3.0
H0553	Human Placenta	Human Placenta				pCMVSPORT 3.0
H0555	Rejected Kidney, lib 4	Human Rejected Kidney	Kidney		disease	pCMVSPORT 3.0
H0560	KMH2	KMH2				pCMVSPORT 3.0
H0587	Healing groin wound; 7.5 hours post incision	Groin-2/19/97	groin		disease	pCMVSPORT 3.0
H0592	Healing groin wound - zero hr post-incision (control)	HGS wound healing project; abdomen			disease	pCMVSPORT 3.0
H0593	Olfactory epithelium;nasalcavity	Olfactory epithelium from roof of left nasal cavity				pCMVSPORT 3.0
H0596	Human Colon Cancer;re-excision	Human Colon Cancer	Colon			Lambda ZAP II
H0606	Human Primary Breast Cancer;re-excision	Human Primary Breast Cancer	Breast		disease	Uni-ZAP XR
H0615	Human Ovarian Cancer Reexcision	Ovarian Cancer	Ovary		disease	Uni-ZAP XR
H0616	Human Testes, Reexcision	Human Testes	Testis			Uni-ZAP XR
H0617	Human Primary Breast Cancer Reexcision	Human Primary Breast Cancer	Breast		disease	Uni-ZAP XR
H0618	Human Adult Testes, Large Inserts, Reexcision	Human Adult Testis	Testis			Uni-ZAP XR
H0623	Human Umbilical Vein; Reexcision	Human Umbilical Vein Endothelial Cells	Umbilical vein			Uni-ZAP XR
H0632	Hepatocellular Tumor;re-excision	Hepatocellular Tumor	Liver			Lambda ZAP II
H0634	Human Testes Tumor, re-excision	Human Testes Tumor	Testis		disease	Uni-ZAP XR
H0641	LPS activated derived dendritic cells	LPS activated monocyte derived dendritic cells				pSport I
H0643	Hep G2 Cells, PCR library	Hep G2 Cells				Other
H0644	Human Placenta (re-excision)	Human Placenta	Placenta			Uni-ZAP XR
H0646	Lung, Cancer (4005313 A3): Invasive Poorly Differentiated Lung Adenocarcinoma,	Metastatic squamous cell lung carcinoma, poorly di				pSport I
H0647	Lung, Cancer (4005163 B7): Invasive, Poorly Diff. Adenocarcinoma, Metastatic	Invasive poorly differentiated lung adenocarcinoma			disease	pSport I
H0648	Ovary, Cancer: (4004562 B6) Papillary Serous Cystic Neoplasm, Low Malignant Pot	Papillary Cystic neoplasm of low malignant potentia			disease	pSport I
H0650	B-Cells	B-Cells				pCMVSPORT 3.0
H0651	Ovary, Normal: (9805C040R)	Normal Ovary				pSport I
H0657	B-cells (stimulated)	B-cells (stimulated)				pSport I

H0658	Ovary, Cancer (9809C332): Poorly differentiated adenocarcinoma	9809C332- Poorly differentiate	Ovary & Fallopian Tubes		disease	pSport I
H0659	Ovary, Cancer (15395A1F): Grade II Papillary Carcinoma	Grade II Papillary, Carcinoma, Ovary	Ovary		disease	pSport I
H0660	Ovary, Cancer: (15799A1F) Poorly differentiated carcinoma	Poorly differentiated carcinoma, ovary			disease	pSport I
H0661	Breast, Cancer: (4004943 A5)	Breast cancer			disease	pSport I
H0662	Breast, Normal: (4005522B2)	Normal Breast - #4005522(B2)	Breast			pSport I
H0663	Breast, Cancer: (4005522 A2)	Breast Cancer - #4005522(A2)	Breast		disease	pSport I
H0664	Breast, Cancer: (9806C012R)	Breast Cancer	Breast		disease	pSport I
H0666	Ovary, Cancer: (4004332 A2)	Ovarian Cancer, Sample #4004332A2			disease	pSport I
H0670	Ovary, Cancer(4004650 A3): Well-Differentiated Micropapillary Serous Carcinoma	Ovarian Cancer - 4004650A3				pSport I
H0672	Ovary, Cancer: (4004576 A8)	Ovarian Cancer(4004576A8)	Ovary			pSport I
H0673	Human Prostate Cancer, Stage B2; re-excision	Human Prostate Cancer, stage B2	Prostate			Uni-ZAP XR
H0674	Human Prostate Cancer, Stage C; re-excision	Human Prostate Cancer, stage C	Prostate			Uni-ZAP XR
H0676	Colon, Cancer: (9808C064R)-total RNA	Colon Cancer 9808C064R				pCMVSPORT 3.0
H0678	screened clones from placental library	Placenta	Placenta			Other
H0683	Ovarian Serous Papillary Adenocarcinoma	Serous papillary adenocarcinoma, stage 3C (9804G01)				pCMVSPORT 3.0
H0685	Adenocarcinoma of Ovary, Human Cell Line, # OVCAR-3	Adenocarcinoma of Ovary, Human Cell Line, # OVCAR-				pCMVSPORT 3.0
H0686	Adenocarcinoma of Ovary, Human Cell Line	Adenocarcinoma of Ovary, Human Cell Line, # SW-626				pCMVSPORT 3.0
H0687	Human normal ovary(#9610G215)	Human normal ovary(#9610G215)	Ovary			pCMVSPORT 3.0
H0688	Human Ovarian Cancer(#9807G017)	Human Ovarian cancer(#9807G017), mRNA from Maura Ru				pCMVSPORT 3.0
H0689	Ovarian Cancer	Ovarian Cancer, #9806G019				pCMVSPORT 3.0
H0690	Ovarian Cancer, # 9702G001	Ovarian Cancer, #9702G001				pCMVSPORT 3.0
S0004	Prostate	Prostate BPH	Prostate			Lambda ZAP II
S0013	Prostate	Prostate	prostate			Uni-ZAP XR
S0014	Kidney Cortex	Kidney cortex	Kidney			Uni-ZAP XR
S0026	Stromal cell TF274	stromal cell	Bone marrow	Cell Line		Uni-ZAP XR
S0028	Smooth muscle, control	Smooth muscle	Pulmonary artery	Cell Line		Uni-ZAP XR
S0042	Testes	Human Testes				ZAP Express

S0044	Prostate BPH	prostate BPH	Prostate		disease	Uni-ZAP XR
S0052	neutrophils control	human neutrophils	blood	Cell Line		Uni-ZAP XR
S0112	Hypothalamus		Brain			Uni-ZAP XR
S0134	Apoptotic T-cell	apoptotic cells		Cell Line		Uni-ZAP XR
S0146	prostate-edited	prostate BPH	Prostate			Uni-ZAP XR
S0148	Normal Prostate	Prostate	prostate			Uni-ZAP XR
S0150	LNCAP prostate cell line	LNCAP Cell Line	Prostate	Cell Line		Uni-ZAP XR
S0152	PC3 Prostate cell line	PC3 prostate cell line				Uni-ZAP XR
S0168	Prostate/LNCAP, subtraction I	PC3 prostate cell line				pBluescript
S0174	Prostate-BPH subtracted II	Human Prostate BPH				pBluescript
S0176	Prostate, normal, subtraction I	Prostate	prostate			Uni-ZAP XR
S0188	Prostate,BPH, Lib 2	Human Prostate BPH			disease	pSport I
S0190	Prostate BPH,Lib 2, subtracted	Human Prostate BPH				pSport I
S0212	Bone Marrow Stromal Cell, untreated	Bone Marrow Stromal Cell, untreated				pSport I
S0222	H. Frontal cortex, epileptic; re-excision	H. Brain, Frontal Cortex, Epileptic	Brain		disease	Uni-ZAP XR
S0242	Synovial Fibroblasts (III/TNF), subt	Synovial Fibroblasts				pSport I
S0274	PCMIX	PCMIX (Human Cerebellum)	Brain			PCR II
S0282	Brain Frontal Cortex, re-excision	Brain frontal cortex	Brain			Lambda ZAP II
S0284	7TMCTT (Testis)	7TMCTP (Placenta)	Testis			PCR II
S0286	7TMCTP (Placenta)	H7MCTP (PLACENTA)	Placenta			PCR II
S0294	Larynx tumor	Larynx tumor	Larynx, vocal cord		disease	pSport I
S0326	Mammary Gland	Mammary Gland	Whole mammary gland			pSport I
S0328	Palate carcinoma	Palate carcinoma	Uvula		disease	pSport I
S0352	Larynx Carcinoma	Larynx carcinoma			disease	pSport I
S0354	Colon Normal II	Colon Normal	Colon			pSport I
S0358	Colon Normal III	Colon Normal	Colon			pSport I
S0360	Colon Tumor II	Colon Tumor	Colon		disease	pSport I
S0374	Normal colon	Normal colon				pSport I
S0380	Pancreas Tumor PCA4 Tu	Pancreas Tumor PCA4 Tu			disease	pSport I
S0396	Uterus; normal	Uterus; normal				pSport I
S0398	Testis; normal	Testis; normal				pSport I
S0412	Temporal cortex- Alzheimer; subtracted	Temporal cortex, alzheimer			disease	Other
S0422	Mo7e Cell Line GM-CSF treated (1ng/ml)	Mo7e Cell Line GM-CSF treated (1ng/ml)				pcMVSPORT 3.0
S0424	TF-1 Cell Line GM-CSF Treated	TF-1 Cell Line GM-CSF Treated				pSport I
S0442	Colon Normal	Colon Normal				pSport I
S0444	Colon Tumor	Colon Tumour			disease	pSport I
S0454	Placenta	Placenta	Placenta			pSport I
S0456	Tongue Normal	Tongue Normal				pSport I
S0460	Thyroid Tumour	Thyroid Tumour				pSport I

T0010	Human Infant Brain	Human Infant Brain				Other
T0041	Jurkat T-cell G1 phase	Jurkat T-cell				pBluescript SK-
T0068	Normal Ovary, Premenopausal	Normal Ovary, Premenopausal				pBluescript SK-
T0069	Human Uterus, normal	Human Uterus, normal				pBluescript SK-
L0095	Cloñtech human aorta polyA+ mRNA (#6572)					
L0021	Human adult (K.Okubo)					
L0023	human adult testis					
L0040	Human colon mucosa					
L0041	Human epidermal keratinocyte					
L0060	Human thymus NSTH II					
L0070	Selected chromosome 21 cDNA library					
L0109	Human brain cDNA	brain				
L0142	Human placenta cDNA (TFujiwara)	placenta				
L0143	Human placenta polyA+ (TFujiwara)	placenta				
L0151	Human testis (C. De Smet)	testis				
L0157	Human fetal brain (TFujiwara)		brain			
L0163	Human heart cDNA (YNakamura)		heart			
L0351	Infant brain, Bento Soares					BA, M13-derived
L0352	Normalized infant brain, Bento Soares					BA, M13-derived
L0361	Stratagene ovary (#937217)		ovary			Bluescript SK
L0362	Stratagene ovarian cancer (#937219)					Bluescript SK-
L0363	NCI_CGAP_GC2	germ cell tumor				Bluescript SK-
L0365	NCI_CGAP_Phe1	pheochromocytoma				Bluescript SK-
L0366	Stratagene schizo brain S11	schizophrenic brain S-11 frontal lobe				Bluescript SK-
L0367	NCI_CGAP_Sch1	Schwannoma tumor				Bluescript SK-
L0369	NCI_CGAP_AA1	adrenal adenoma	adrenal gland			Bluescript SK-
L0371	NCI_CGAP_Br3	breast tumor	breast			Bluescript SK-
L0372	NCI_CGAP_Co12	colon tumor	colon			Bluescript SK-
L0373	NCI_CGAP_Co11	tumor	colon			Bluescript SK-
L0374	NCI_CGAP_Co2	tumor	colon			Bluescript SK-
L0375	NCI_CGAP_Kid6	kidney tumor	kidney			Bluescript SK-
L0376	NCI_CGAP_Lar1	larynx	larynx			Bluescript SK-
L0378	NCI_CGAP_Lu1	lung tumor	lung			Bluescript SK-
L0380	NCI_CGAP_HN1	squamous cell	lymph node			Bluescript

L0381	NCI_CGAP_HN4	carcinoma squamous cell carcinoma	pharynx			SK- Bluescript SK-
L0383	NCI_CGAP_Pr24	invasive tumor (cell line)	prostate			Bluescript SK-
L0411	1-NIB					Lafmid BA
L0435	Infant brain, LLNL array of Dr. M. Soares 1NIB					lafmid BA
L0438	normalized infant brain cDNA	total brain	brain			lafmid BA
L0439	Soares infant brain 1NIB		whole brain			Lafmid BA
L0441	2HB3MK					Lafmid BK
L0455	Human retina cDNA randomly primed sublibrary	retina	eye			lambda gt10
L0462	WATM1					lambda gt11
L0465	TEST1, Human adult Testis tissue					lambda nml149
L0470	BL29 Burkitt's lymphoma, Pascalis Sideras					lambda ZAP 2
L0471	Human fetal heart, Lambda ZAP Express					Lambda ZAP Express
L0475	KG1-a Lambda Zap Express cDNA library			KG1-a		Lambda Zap Express (Stratagene)
L0480	Stratagene cat#937212 (1992)					Lambda ZAP, pBluescript SK(-)
L0483	Human pancreatic islet					Lambda ZAPII
L0485	STRATAGENE Human skeletal muscle cDNA library, cat. #936215.	skeletal muscle	leg muscle			Lambda ZAPII
L0492	Human Genomic					pAMP
L0509	NCI_CGAP_Lu26	invasive adenocarcinoma	lung			pAMP1
L0512	NCI_CGAP_Ov36	borderline ovarian carcinoma	ovary			pAMP1
L0513	NCI_CGAP_Ov37	early stage papillary serous carcinoma	ovary			pAMP1
L0515	NCI_CGAP_Ov32	papillary serous carcinoma	ovary			pAMP1
L0516	Chromosome 19p12-p13.1 exon					pAMP10
L0517	NCI CGAP Pr1					pAMP10
L0518	NCI CGAP Pr2					pAMP10
L0519	NCI CGAP Pr3					pAMP10
L0520	NCI_CGAP_Alv1	alveolar rhabdomyosarcoma				pAMP10
L0521	NCI CGAP Ew1	Ewing's sarcoma				pAMP10
L0522	NCI CGAP Kid1	kidney				pAMP10
L0523	NCI CGAP Lip2	liposarcoma				pAMP10
L0524	NCI CGAP Li1	liver				pAMP10
L0526	NCI_CGAP_Pr12	metastatic prostate bone lesion				pAMP10
L0527	NCI CGAP Ov2	ovary				pAMP10
L0528	NCI CGAP Pr5	prostate				pAMP10
L0529	NCI CGAP Pr6	prostate				pAMP10
L0532	NCI CGAP Thy1	thyroid				pAMP10

L0533	NCI CGAP HSCI	stem cells	bone marrow		pAMP10
L0534	Chromosome 7 Fetal Brain cDNA Library	brain	brain		pAMP10
L0536	NCI CGAP Br4	normal ductal tissue	breast		pAMP10
L0539	Chromosome 7 Placental cDNA Library		placenta		pAMP10
L0542	NCI CGAP_Pr11	normal prostatic epithelial cells	prostate		pAMP10
L0547	NCI CGAP_Pr16	tumor	prostate		pAMP10
L0558	NCI CGAP_Ov40	endometrioid ovarian metastasis	ovary		pAMP10
L0565	Normal Human Trabecular Bone Cells	Bone	Hip		pBluescript
L0581	Stratagene liver (#937224)		liver		pBluescript SK
L0586	HTCDLI				pBluescript SK(-)
L0587	Stratagene colon HT29 (#937221)				pBluescript SK-
L0588	Stratagene endothelial cell 937223				pBluescript SK-
L0589	Stratagene fetal retina 937202				pBluescript SK-
L0590	Stratagene fibroblast (#937212)				pBluescript SK-
L0591	Stratagene HeLa cell s3 937216				pBluescript SK-
L0592	Stratagene hNT neuron (#937233)				pBluescript SK-
L0593	Stratagene neuroepithelium (#937231)				pBluescript SK-
L0594	Stratagene neuroepithelium NT2RAMI 937234				pBluescript SK-
L0595	Stratagene NT2 neuronal precursor 937230	neuroepithelial cells	brain		pBluescript SK-
L0596	Stratagene colon (#937204)		colon		pBluescript SK-
L0597	Stratagene corneal stroma (#937222)		cornea		pBluescript SK-
L0598	Morton Fetal Cochlea	cochlea	ear		pBluescript SK-
L0599	Stratagene lung (#937210)		lung		pBluescript SK-
L0600	Weizmann Olfactory Epithelium	olfactory epithelium	nose		pBluescript SK-
L0601	Stratagene pancreas (#937208)		pancreas		pBluescript SK-
L0602	Pancreatic Islet	pancreatic islet	pancreas		pBluescript SK-
L0603	Stratagene placenta (#937225)		placenta		pBluescript SK-
L0604	Stratagene muscle 937209	muscle	skeletal muscle		pBluescript SK-
L0605	Stratagene fetal spleen (#937205)	fetal spleen	spleen		pBluescript SK-
L0606	NCI CGAP_Lym5	follicular lymphoma	lymph node		pBluescript SK-
L0608	Stratagene lung carcinoma 937218	lung carcinoma	lung	NCI-H69	pBluescript SK-

L0612	Schiller oligodendroglioma	oligodendroglioma	brain			pBluescript SK- (Stratagene)
L0617	Chromosome 22 exon					pBluescriptII KS+
L0618	Chromosome 9 exon					pBluescriptII KS+
L0623	HM3	pectoral muscle (after mastectomy)				pcDNAII (Invitrogen)
L0626	NCI_CGAP_GC1	bulk germ cell seminoma				pCMV-SPORT2
L0635	NCI_CGAP_PNS1	dorsal root ganglion	peripheral nervous system			pCMV-SPORT4
L0637	NCI_CGAP_Brn53	three pooled meningiomas	brain			pCMV-SPORT6
L0638	NCI_CGAP_Brn35	tumor, 5 pooled (see description)	brain			pCMV-SPORT6
L0639	NCI_CGAP_Brn52	tumor, 5 pooled (see description)	brain			pCMV-SPORT6
L0642	NCI_CGAP_Co18	moderately differentiated adenocarcinoma	colon			pCMV-SPORT6
L0646	NCI_CGAP_Co14	moderately-differentiated adenocarcinoma	colon			pCMV-SPORT6
L0647	NCI_CGAP_Sar4	five pooled sarcomas, including myxoid liposarcoma	connective tissue			pCMV-SPORT6
L0649	NCI_CGAP_GUI	2 pooled high-grade transitional cell tumors	genitourinary tract			pCMV-SPORT6
L0655	NCI_CGAP_Lym12	lymphoma, follicular mixed small and large cell	lymph node			pCMV-SPORT6
L0656	NCI_CGAP_Ov38	normal epithelium	ovary			pCMV-SPORT6
L0657	NCI_CGAP_Ov23	tumor, 5 pooled (see description)	ovary			pCMV-SPORT6
L0658	NCI_CGAP_Ov35	tumor, 5 pooled (see description)	ovary			pCMV-SPORT6
L0659	NCI_CGAP_Pan1	adenocarcinoma	pancreas			pCMV-SPORT6
L0661	NCI_CGAP_Mel15	malignant melanoma, metastatic to lymph node	skin			pCMV-SPORT6
L0662	NCI_CGAP_Gas4	poorly differentiated adenocarcinoma with signet r	stomach			pCMV-SPORT6
L0663	NCI_CGAP_Ut2	moderately-differentiated endometrial adenocarcino	uterus			pCMV-SPORT6
L0664	NCI_CGAP_Ut3	poorly-differentiated endometrial adenocarcinoma,	uterus			pCMV-SPORT6
L0665	NCI_CGAP_Ut4	serous papillary carcinoma, high grade, 2 pooled t	uterus			pCMV-SPORT6
L0666	NCI_CGAP_Ut1	well-differentiated endometrial	uterus			pCMV-SPORT6

		adenocarcinoma, 7				
L0667	NCI_CGAP_CML1	myeloid cells, 18 pooled CML cases, BCR/ABL rcarra	whole blood			pCMV- SPORT6
L0686	Stanley Frontal SN pool 2	frontal lobe (see description)	brain			pCR2.1- TOPO (Invitrogen)
L0697	Testis 1					PGEM 5zf(-)
L0698	Testis 2					PGEM 5zf(+)
L0700	Outward Alu-primed hncDNA library					pGEM-37
L0717	Gessler Wilms tumor					pSPORT1
L0731	Soares_pregnant_uterus_ NbHPU		uterus			pT7T3-Pac
L0738	Human colorectal cancer					pT7T3D
L0740	Soares melanocyte 2NbHM	melanocyte				pT7T3D (Pharmacia) with a modified polylinker
L0741	Soares adult brain N2b4HB55Y		brain			pT7T3D (Pharmacia) with a modified polylinker
L0742	Soares adult brain N2b5HB55Y		brain			pT7T3D (Pharmacia) with a modified polylinker
L0743	Soares breast 2NbHBst		breast			pT7T3D (Pharmacia) with a modified polylinker
L0744	Soares breast 3NbHBst		breast			pT7T3D (Pharmacia) with a modified polylinker
L0745	Soares retina N2b4HR	retina	eye			pT7T3D (Pharmacia) with a modified polylinker
L0746	Soares retina N2b5HR	retina	eye			pT7T3D (Pharmacia) with a modified polylinker
L0747	Soares_fetal_heart_NbHH 19W		heart			pT7T3D (Pharmacia) with a modified polylinker
L0748	Soares fetal liver spleen 1NFLS		Liver and Spleen			pT7T3D (Pharmacia) with a modified polylinker

L0749	Soares_fetal_liver_spleen _1NFLS_SI		Liver and Spleen			pT7T3D (Pharmacia) with a modified polylinker
L0750	Soares_fetal_lung_NbHL1 9W		lung			pT7T3D (Pharmacia) with a modified polylinker
L0751	Soares ovary tumor NbHOT	ovarian tumor	ovary			pT7T3D (Pharmacia) with a modified polylinker
L0752	Soares_parathyroid_tumor _NbHPA	parathyroid tumor	parathyroid gland			pT7T3D (Pharmacia) with a modified polylinker
L0753	Soares_pineal_gland_N3H PG		pineal gland			pT7T3D (Pharmacia) with a modified polylinker
L0754	Soares placenta Nb2HP		placenta			pT7T3D (Pharmacia) with a modified polylinker
L0755	Soares_placenta_8to9wee ks_2NbHP8to9W		placenta			pT7T3D (Pharmacia) with a modified polylinker
L0756	Soares_multiple_sclerosis _2NbHMSP	multiple sclerosis lesions				pT7T3D (Pharmacia) with a modified polylinker V TYPE
L0757	Soares_senescent_fibrobla sts_NbHSF	senescent fibroblast				pT7T3D (Pharmacia) with a modified polylinker V TYPE
L0758	Soares_testis_NHT					pT7T3D-Pac (Pharmacia) with a modified polylinker
L0759	Soares_total_fetus_Nb2H F8_9w					pT7T3D-Pac (Pharmacia) with a modified polylinker
L0761	NCI_CGAP_CLL1	B-cell, chronic lymphocytic leukemia				pT7T3D-Pac (Pharmacia) with a modified polylinker
L0762	NCI_CGAP_Br1.1	breast				pT7T3D-Pac

						(Pharmacia) with a modified polylinker
L0763	NCI_CGAP_Br2	breast				pT7T3D-Pac (Pharmacia) with a modified polylinker
L0764	NCI_CGAP_Co3	colon				pT7T3D-Pac (Pharmacia) with a modified polylinker
L0765	NCI_CGAP_Co4	colon				pT7T3D-Pac (Pharmacia) with a modified polylinker
L0766	NCI_CGAP_GCB1	germinal center B cell				pT7T3D-Pac (Pharmacia) with a modified polylinker
L0767	NCI_CGAP_GC3	pooled germ cell tumors				pT7T3D-Pac (Pharmacia) with a modified polylinker
L0768	NCI_CGAP_GC4	pooled germ cell tumors				pT7T3D-Pac (Pharmacia) with a modified polylinker
L0769	NCI_CGAP_Bm25	anaplastic oligodendroglioma	brain			pT7T3D-Pac (Pharmacia) with a modified polylinker
L0770	NCI_CGAP_Bm23	glioblastoma (pooled)	brain			pT7T3D-Pac (Pharmacia) with a modified polylinker
L0771	NCI_CGAP_Co8	adenocarcinoma	colon			pT7T3D-Pac (Pharmacia) with a modified polylinker
L0772	NCI_CGAP_Co10	colon tumor RER+	colon			pT7T3D-Pac (Pharmacia) with a modified polylinker
L0773	NCI_CGAP_Co9	colon tumor RER+	colon			pT7T3D-Pac (Pharmacia) with a modified polylinker
L0774	NCI_CGAP_Kid3		kidney			pT7T3D-Pac (Pharmacia) with a modified

						polylinker
L0775	NCI_CGAP_Kid5	2 pooled tumors (clear cell type)	kidney			pT7T3D-Pac (Pharmacia) with a modified polylinker
L0776	NCI_CGAP_Lu5	carcinoid	lung			pT7T3D-Pac (Pharmacia) with a modified polylinker
L0777	Soares_NhHMPu_S1	Pooled human melanocyte, fetal heart, and pregnant	mixed (see below)			pT7T3D-Pac (Pharmacia) with a modified polylinker
L0779	Soares_NFL_T_GBC_S1		pooled			pT7T3D-Pac (Pharmacia) with a modified polylinker
L0780	Soares_NSF_F8_9W_OT _PA_P_S1		pooled			pT7T3D-Pac (Pharmacia) with a modified polylinker
L0782	NCI_CGAP_Pr21	normal prostate	prostate			pT7T3D-Pac (Pharmacia) with a modified polylinker
L0783	NCI_CGAP_Pr22	normal prostate	prostate			pT7T3D-Pac (Pharmacia) with a modified polylinker
L0786	Soares_NbHFB		whole brain			pT7T3D-Pac (Pharmacia) with a modified polylinker
L0787	NCI_CGAP_Sub1					pT7T3D-Pac (Pharmacia) with a modified polylinker
L0788	NCI_CGAP_Sub2					pT7T3D-Pac (Pharmacia) with a modified polylinker
L0789	NCI_CGAP_Sub3					pT7T3D-Pac (Pharmacia) with a modified polylinker
L0790	NCI_CGAP_Sub4					pT7T3D-Pac (Pharmacia) with a modified polylinker
L0791	NCI_CGAP_Sub5					pT7T3D-Pac (Pharmacia)

						with a modified polylinker
L0792	NCI_CGAP_Sub6					pT7T3D-Pac (Pharmacia) with a modified polylinker
L0794	NCI_CGAP_GC6	pooled germ cell tumors				pT7T3D-Pac (Pharmacia) with a modified polylinker
L0796	NCI_CGAP_Brn50	medulloblastoma	brain			pT7T3D-Pac (Pharmacia) with a modified polylinker
L0800	NCI_CGAP_Co16	colon tumor, RER+	colon			pT7T3D-Pac (Pharmacia) with a modified polylinker
L0803	NCI_CGAP_Kid11		kidney			pT7T3D-Pac (Pharmacia) with a modified polylinker
L0804	NCI_CGAP_Kid12	2 pooled tumors (clear cell type)	kidney			pT7T3D-Pac (Pharmacia) with a modified polylinker
L0805	NCI_CGAP_Lu24	carcinoid	lung			pT7T3D-Pac (Pharmacia) with a modified polylinker
L0806	NCI_CGAP_Lu19	squamous cell carcinoma, poorly differentiated (4	lung			pT7T3D-Pac (Pharmacia) with a modified polylinker
L0807	NCI_CGAP_Ov18	fibrotheoma	ovary			pT7T3D-Pac (Pharmacia) with a modified polylinker
L0809	NCI_CGAP_Pr28		prostate			pT7T3D-Pac (Pharmacia) with a modified polylinker

TABLE 5

OMIM Reference	Description
102200	Somatotrophinoma
102480	Male infertility due to acrosin deficiency
102770	Myoadenylate deaminase deficiency
103050	Autism, succinylpurinemic
103050	Adenylosuccinase deficiency
104770	Amyloidosis, secondary, susceptibility to
106100	Angioedema, hereditary
106150	Hypertension, essential, susceptibility to
106150	Preeclampsia, susceptibility to
106300	Ankylosing spondylitis
107670	Apolipoprotein A-II deficiency
107741	Hyperlipoproteinemia, type III
107910	Virilization, maternal and fetal, from placental aromatase deficiency
107910	Gynecomastia, familial, due to increased aromatase activity
108725	Atherosclerosis, susceptibility to
108800	Atrial septal defect, secundum type
108962	Hypertension, salt-resistant
109270	Renal tubular acidosis, distal, 179800
109270	Spherocytosis, hereditary
109270	[Acanthocytosis, one form]
109270	[Elliptocytosis, Malaysian-Melanesian type]
109270	Hemolytic anemia due to band 3 defect
109400	Basal cell nevus syndrome
109700	Hemodialysis-related amyloidosis
110700	Vivax malaria, susceptibility to
113100	Brachydactyly, type C
113705	Ovarian cancer
113705	Breast cancer-1
113721	Breast cancer
113900	Heart block, progressive familial, type I
114240	Muscular dystrophy, limb-girdle, type 2A, 253600
116806	Colorectal cancer
118485	Polycystic ovary syndrome with hyperandrogenemia
118504	Epilepsy, benign neonatal, type 1, 121200
118504	Epilepsy, nocturnal frontal lobe, 600513
118800	Choreoathetosis, familial paroxysmal
120110	Metaphyseal chondrodysplasia, Schmid type
120120	Epidermolysis bullosa dystrophica, dominant, 131750
120120	Epidermolysis bullosa dystrophica, recessive, 226600
120120	Epidermolysis bullosa, pretibial, 131850
120215	Ehlers-Danlos syndrome, type I, 130000

120215	Ehlers-Danlos syndrome, type II, 130010
120280	Stickler syndrome, type III
120280	Marshall syndrome, 154780
120290	OSMED syndrome, 215150
120290	Stickler syndrome, type II, 184840
120435	Muir-Torre syndrome, 158320
120435	Colorectal cancer, hereditary, nonpolyposis, type 1 Ovarian cancer
120436	Muir-Torre family cancer syndrome, 158320
120436	Turcot syndrome with glioblastoma, 276300
120436	Colorectal cancer, hereditary nonpolyposis, type 2
120700	C3 deficiency
120810	C4 deficiency
120820	C4 deficiency
120940	C9 deficiency
121011	Deafness, autosomal dominant 3, 601544
121011	Deafness, autosomal recessive 1, 220290
121014	Heterotaxia, viscerotaxial, autosomal recessive
122720	Nicotine addiction, protection from
122720	Coumarin resistance, 122700
123620	Cataract, cerulean, type 2, 601547
123660	Cataract, Coppock-like
124030	Parkinsonism, susceptibility to
124030	Debrisoquine sensitivity
124200	Darier disease (keratosis follicularis)
125270	Porphyria, acute hepatic
125270	Lead poisoning, susceptibility to
125660	Myopathy, desminopathic
125660	Cardiomyopathy
125852	Insulin-dependent diabetes mellitus-2
126340	Xeroderma pigmentosum, group D, 278730
126391	DNA ligase I deficiency
126452	Autonomic nervous system dysfunction
126452	[Novelty seeking personality]
126600	Drusen, radial, autosomal dominant
126650	Chloride diarrhea, congenital, Finnish type, 214700
126650	Colon cancer
128100	Dystonia-1, torsion
129500	Ectodermal dysplasia, hidrotic
130410	Glutaricaciduria, type IIB
131100	Multiple endocrine neoplasia I
131100	Prolactinoma, hyperparathyroidism, carcinoid syndrome
131100	Carcinoid tumor of lung
131242	Shah-Waardenburg syndrome, 277580
132800	Basal cell carcinoma
132800	Epithelioma, self-healing, squamous 1, Ferguson-Smith type

133171	[Erythrocytosis, familial], 133100
133450	Neuroepithelioma
133450	Ewing sarcoma
133701	Exostoses, multiple, type 2
133780	Vitreoretinopathy, exudative, familial
134580	Factor XIIIB deficiency
134790	Hyperferritinemia-cataract syndrome, 600886
134797	Shprintzen-Goldberg syndrome, 182212
134797	Ectopia lentis, isolated
134797	Marfan syndrome, 154700
135300	Fibromatosis, gingival
135940	Ichthyosis vulgaris, 146700
136350	Pfeiffer syndrome, 101600
136435	Ovarian dysgenesis, hypergonadotropic, with normal karyotype, 233300
136550	Macular dystrophy, North Carolina type
136836	Fucosyltransferase-6 deficiency
137350	Amyloidosis, Finnish type, 105120
138079	Hyperinsulinism, familial, 602485
138079	MODY, type 2, 125851
138320	Hemolytic anemia due to glutathione peroxidase deficiency
138570	Non-insulin dependent diabetes mellitus, susceptibility to
138720	Bernard-Soulier syndrome, type B
138981	Pulmonary alveolar proteinosis, 265120
139191	Growth hormone deficient dwarfism
139320	Pituitary ACTH secreting adenoma
139320	Pseudohypoparathyroidism, type Ia, 103580
139320	Somatotrophinoma
139320	McCune-Albright polyostotic fibrous dysplasia, 174800
141750	Alpha-thalassemia/mental retardation syndrome, type 1
141800	Methemoglobinemias, alpha-
141800	Thalassemias, alpha-
141800	Erythremias, alpha-
141800	Heinz body anemias, alpha-
141850	Thalassemia, alpha-
141850	Erythrocytosis
141850	Heinz body anemia
141850	Hemoglobin H disease
141850	Hypochromic microcytic anemia
141900	Methemoglobinemias, beta-
141900	Sickle cell anemia
141900	Thalassemias, beta-
141900	Erythremias, beta-
141900	HPFH, deletion type
141900	Heinz body anemias, beta-

142000	Thalassemia due to Hb Lepore
142000	Thalassemia, delta-
142200	HPFH, nondeletion type A
142250	HPFH, nondeletion type G
142270	Hereditary persistence of fetal hemoglobin
142470	[Hereditary persistence of fetal hemoglobin, heterocellular]
142857	Pemphigoid, susceptibility to
142858	Beryllium disease, chronic, susceptibility to
142959	Hand-foot-uterus syndrome, 140000
143890	Hypercholesterolemia, familial
144200	Epidermolytic palmoplantar keratoderma
145001	Hyperparathyroidism-jaw tumor syndrome
145260	Pseudohypoaldosteronism, type II
145410	Opitz G syndrome, type II
145981	Hypocalciuric hypercalcemia, type II
146760	[IgG receptor I, phagocytic, familial deficiency of]
146790	Lupus nephritis, susceptibility to
147050	Atopy
147141	Leukemia, acute lymphoblastic
147200	[Kappa light chain deficiency]
147440	Growth retardation with deafness and mental retardation
147670	Rabson-Mendenhall syndrome
147670	Diabetes mellitus, insulin-resistant, with acanthosis nigricans
147670	Leprechaunism
148065	White sponge nevus, 193900
148066	Epidermolysis bullosa simplex, Koebner, Dowling-Meara, and Weber-Cockayne types, 131900, 131760, 131800
148066	Epidermolysis bullosa simplex, recessive, 601001
148067	Nonepidermolytic palmoplantar keratoderma, 600962
148067	Pachyonychia congenita, Jadassohn-Lewandowsky type, 167200
148069	Pachyonychia congenita, Jackson-Lawler type, 167210
148080	Epidermolytic hyperkeratosis, 113800
150270	Laryngeal adductor paralysis
151400	Leukemia/lymphoma, B-cell, 1
151440	Leukemia, T-cell acute lymphoblastoid
151670	Hepatic lipase deficiency
152200	Coronary artery disease, susceptibility to
152445	Vohwinkel syndrome, 124500
152445	Erythrokeratoderma, progressive symmetric, 602036
152760	Hypogonadotropic hypogonadism due to GNRH deficiency, 227200
152790	Precocious puberty, male, 176410
152790	Leydig cell hypoplasia
153700	Macular dystrophy, vitelliform type
153880	Macular dystrophy, dominant cystoid

154275	Malignant hyperthermia susceptibility 2
154276	Malignant hyperthermia susceptibility 3
155555	[Red hair/fair skin]
155555	UV-induced skin damage, vulnerability to
156225	Muscular dystrophy, congenital merosin-deficient
156850	Cataract, congenital, with microphthalmia
157170	Holoprosencephaly-2
158590	Spinal muscular atrophy-4
159001	Muscular dystrophy, limb-girdle, type 1B
160781	Cardiomyopathy, hypertrophic, mid-left ventricular chamber type
160900	Myotonic dystrophy
161015	Mitochondrial complex I deficiency, 252010
163950	Noonan syndrome-1
163950	Cardiofaciocutaneous syndrome, 115150
164009	Leukemia, acute promyelocytic, NUMA/RARA type
164200	Oculodentodigital dysplasia
164200	Syndactyly, type III, 186100
164731	Ovarian carcinoma, 167000
164953	Liposarcoma
166600	Osteopetrosis, AD, type II
167000	Ovarian cancer, serous
167250	Paget disease of bone
168461	Multiple myeloma, 254250
168461	Parathyroid adenomatosis 1
168461	Centrocytic lymphoma
168468	Metaphyseal chondrodysplasia, Murk Jansen type, 156400
168500	Parietal foramina
168610	Parkinsonism-dementia with pallidopontonigral degeneration
170261	Bare lymphocyte syndrome, type I, due to TAP2 deficiency
170995	Zellweger syndrome-2
171190	Hypertension, essential, 145500
171650	Lysosomal acid phosphatase deficiency
172400	Hemolytic anemia due to glucosephosphate isomerase deficiency
172400	Hydrops fetalis, one form
173360	Thrombophilia due to excessive plasminogen activator inhibitor
173360	Hemorrhagic diathesis due to PAI1 deficiency
173370	Plasminogen activator deficiency
173850	Polio, susceptibility to
173870	Xeroderma pigmentosum
173870	Fanconi anemia
174000	Medullary cystic kidney disease, AD
176705	Breast cancer, sporadic
176730	Diabetes mellitus, rare form
176730	Hyperproinsulinemia, familial
176730	MODY, one form

176930	Dysprothrombinemia
176930	Hypoprothrombinemia
177900	Psoriasis susceptibility-1
178640	Pulmonary alveolar proteinosis, congenital, 265120
179450	Ragweed sensitivity
179605	Retinitis pigmentosa, digenic
179605	Retinitis pigmentosa-7, peripherin-related
179605	Retinitis punctata albescens
179605	Butterfly dystrophy, retinal
179605	Macular dystrophy
179755	Renal cell carcinoma, papillary, 1
180020	Retinal cone dystrophy-1
180100	Retinitis pigmentosa-1
180104	Retinitis pigmentosa-9
180297	Anemia, hemolytic, Rh-null, suppressor type, 268150
180721	Retinitis pigmentosa, digenic
180840	Susceptibility to IDDM
180901	Malignant hyperthermia susceptibility 1, 145600
180901	Central core disease, 117000
181430	Scapuloperoneal syndrome, myopathic type
182280	Small-cell cancer of lung
182380	Glucose/galactose malabsorption
182601	Spastic paraplegia-4
182860	Pyropoikilocytosis
182860	Spherocytosis, recessive
182860	Elliptocytosis-2
182900	Spherocytosis-2
185430	Atherosclerosis, susceptibility to
185800	Symphalangism, proximal
186580	Arthrocutaneouveal granulomatosis
186855	Leukemia-2, T-cell acute lymphoblastic
188070	Bleeding disorder due to defective thromboxane A2 receptor
188540	Hypothyroidism, nongoitrous
188826	Sorsby fundus dystrophy, 136900
189800	Preeclampsia/eclampsia
190020	Bladder cancer, 109800
190040	Dermatofibrosarcoma protuberans
190040	Giant-cell fibroblastoma
190040	Meningioma, SIS-related
190182	Colon cancer
190182	Colorectal cancer, familial nonpolyposis, type 6
190198	Leukemia, T-cell acute lymphoblastic
191092	Tuberous sclerosis-2
191100	Tuberous sclerosis-1
191170	Colorectal cancer, 114500

191170	Li-Fraumeni syndrome
191181	Cervical carcinoma
191290	Segawa syndrome, recessive
191315	Insensitivity to pain, congenital, with anhidrosis, 256800
192500	Jervell and Lange-Nielsen syndrome, 220400
192500	Long QT syndrome-1
193235	Vitreoretinopathy, neovascular inflammatory
193500	Rhabdomyosarcoma, alveolar, 268220
193500	Waardenburg syndrome, type I
193500	Waardenburg syndrome, type III, 148820
193500	Craniofacial-deafness-hand syndrome, 122880
194071	Wilms tumor, type 2
194071	Adrenocortical carcinoma, hereditary, 202300
200350	Acetyl-CoA carboxylase deficiency
201460	Acyl-CoA dehydrogenase, long chain, deficiency of
201910	Adrenal hyperplasia, congenital, due to 21-hydroxylase deficiency
204500	Ceroid-lipofuscinosis, neuronal 2, classic late infantile
205100	Amyotrophic lateral sclerosis, juvenile
207750	Hyperlipoproteinemia, type Ib
209901	Bardet-Biedl syndrome 1
215700	Citrullinemia
216900	Achromatopsia
217000	C2 deficiency
217050	C6 deficiency
217050	Combined C6/C7 deficiency
217070	C7 deficiency
221770	Polycystic lipomembranous osteodysplasia with sclerosing leukencephalopathy
221820	Gliososis, familial progressive subcortical
222100	Diabetes mellitus, insulin-dependent-1
223360	Dopamine-beta-hydroxylase deficiency
223900	Dysautonomia, familial
227646	Fanconi anemia, type D
227650	Fanconi anemia, type A
230400	Galactosemia
230450	Hemolytic anemia due to gamma-glutamylcysteine synthetase deficiency
230800	Gaucher disease
230800	Gaucher disease with cardiovascular calcification
231670	Glutaricaciduria, type I
231680	Glutaricaciduria, type IIA
231950	Glutathioninuria
232200	Glycogen storage disease I
232400	Glycogen storage disease IIIa
232400	Glycogen storage disease IIIb

232600	McArdle disease
232800	Glycogen storage disease VII
233100	[Renal glucosuria]
235200	Hemochromatosis
237300	Carbamoylphosphate synthetase I deficiency
239500	Hyperprolinemia, type I
245050	Ketoacidosis due to SCOT deficiency
247200	Miller-Dieker lissencephaly syndrome
248600	Maple syrup urine disease, type Ia
248611	Maple syrup urine disease, type Ib
249000	Meckel syndrome
250250	Cartilage-hair hypoplasia
251170	Mevalonicaciduria
252920	Sanfilippo syndrome, type B
253000	Mucopolysaccharidosis IVA
253250	Mulibrey nanism
253700	Muscular dystrophy, limb-girdle, type 2C
253800	Walker-Warburg syndrome, 236670
253800	Fukuyama type congenital muscular dystrophy
256540	Galactosialidosis
256550	Sialidosis, type I
256550	Sialidosis, type II
256850	Giant axonal neuropathy-1
258501	3-methylglutaconicaciduria, type III
259700	Osteopetrosis, recessive
259770	Osteoporosis-pseudoglioma syndrome
261510	Pseudo-Zellweger syndrome
262000	Bjornstad syndrome
263200	Polycystic kidney disease, autosomal recessive
266200	Anemia, hemolytic, due to PK deficiency
268900	[Sarcosinemia]
270800	Spastic paraplegia-5A
272800	Tay-Sachs disease
272800	[Hex A pseudodeficiency]
272800	GM2-gangliosidosis, juvenile, adult
275350	Transcobalamin II deficiency
276700	Tyrosinemia, type I
276710	Tyrosinemia, type III
277700	Werner syndrome
278300	Xanthinuria, type I
278700	Xeroderma pigmentosum, group A
300000	Opitz G syndrome, type I
300066	Deafness, X-linked 6, sensorineural
300067	Subcortical laminar heterotopia, X-linked dominant
300067	Lissencephaly, X-linked

300077	Mental retardation, X-linked 29
300121	Subcortical laminar heteropia, X-linked, 300067
300121	Lissencephaly, X-linked, 300067
300123	Mental retardation with isolated growth hormone deficiency
300310	Agammaglobulinemia, type 2, X-linked
300500	Ocular albinism, Nettleship-Falls type
300650	Ocular albinism with sensorineural deafness
301200	Amelogenesis imperfecta
301201	Amelogenesis imperfecta-3, hypoplastic type
301220	Partington syndrome II
301835	Arts syndrome
301845	Bazex syndrome
301900	Borjeson-Forssman-Lehmann syndrome
302350	Nance-Horan syndrome
302950	Chondrodysplasia punctata, X-linked recessive, 302940
304050	Aicardi syndrome
304110	Craniofrontonasal dysplasia
304340	Mental retardation, X-linked, syndromic-5, with Dandy-Walker malformation, basal ganglia disease, and seizures
306100	Gonadal dysgenesis, XY female type
307150	Hypertrichosis, congenital generalized
307700	Hypoparathyroidism, X-linked
308000	HPRT-related gout
308000	Lesch-Nyhan syndrome
308700	Kallmann syndrome
309000	Lowe syndrome
309530	Mental retardation, X-linked 1, non-dysmorphic
309585	Mental retardation, X-linked, syndromic-6, with gynecomastia and obesity
310490	Cowchock syndrome
311200	Oral-facial-digital syndrome 1
311850	Phosphoribosyl pyrophosphate synthetase-related gout
312040	N syndrome, 310465
313850	Thoracoabdominal syndrome
600040	Colorectal cancer
600045	Xeroderma pigmentosum, group E, subtype 2
600059	Retinitis pigmentosa-13
600105	Retinitis pigmentosa-12, autosomal recessive
600119	Muscular dystrophy, Duchenne-like, type 2
600119	Adhalinopathy, primary
600140	Rubenstein-Taybi syndrome, 180849
600163	Long QT syndrome-3
600175	Spinal muscular atrophy, congenital nonprogressive, of lower limbs
600202	Dyslexia, specific, 2
600234	HMG-CoA synthase-2 deficiency

600261	Ehlers-Danlos-like syndrome
600266	Resistance/susceptibility to TB, etc.
600273	Polycystic kidney disease, infantile severe, with tuberous sclerosis
600276	Cerebral arteriopathy with subcortical infarcts and leukoencephalopathy, 125310
600281	Non-insulin-dependent diabetes mellitus, 125853
600281	MODY, type 1, 125850
600309	Atrioventricular canal defect-1
600319	Diabetes mellitus, insulin-dependent, 4
600320	Insulin-dependent diabetes mellitus-5
600364	Cone dystrophy-3, 602093
600374	Bardet-Biedl syndrome 4
600528	CPT deficiency, hepatic, type I, 255120
600617	Lipoid adrenal hyperplasia, 201710
600623	Prostate cancer, 176807
600759	Alzheimer disease-4
600808	Enuresis, nocturnal, 2
600811	Xeroderma pigmentosum, group E, DDB-negative subtype, 278740
600837	Hirschsprung disease, 142623
600839	Bartter syndrome, 241200
600850	Schizophrenia disorder-4
600856	Beckwith-Wiedemann syndrome, 130650
600883	Diabetes mellitus, insulin-dependent, 8
600897	Cataract, zonular pulverulent-1, 116200
600918	Cystinuria, type III
600946	Short stature, autosomal dominant, with normal serum growth hormone binding protein
600946	Short stature, idiopathic
600946	Laron dwarfism, 262500
600957	Persistent Mullerian duct syndrome, type I, 261550
600958	Cardiomyopathy, familial hypertrophic, 4, 115197
600964	Refsum disease, adult, with increased pipecolicacidemia
600983	Pseudohypoaldosteronism type I, autosomal dominant, 177735
600994	Deafness, autosomal dominant 5
600996	Arrhythmogenic right ventricular dysplasia-2
601071	Deafness, autosomal recessive 9
601105	Pycnodysostosis, 265800
601154	Cardiomyopathy, dilated, 1E
601238	Cerebellar ataxia, Cayman type
601277	Ichthyosis, lamellar, type 2
601284	Hereditary hemorrhagic telangiectasia-2, 600376
601313	Polycystic kidney disease, adult type I, 173900
601316	Deafness, autosomal dominant 10
601362	DiGeorge syndrome/velocardiofacial syndrome complex-2
601363	Wilms tumor, type 4

601410	Diabetes mellitus, transient neonatal
601412	Deafness, autosomal dominant 7
601414	Retinitis pigmentosa-18
601498	Peroxisomal biogenesis disorder, complementation group 4
601517	Spinocerebellar ataxia-2, 183090
601545	Lissencephaly-1
601649	Blepharophimosis, epicanthus inversus, and ptosis, type 2
601652	Glaucoma 1A, primary open angle, juvenile-onset, 137750
601666	Insulin-dependent diabetes mellitus-15
601669	Hirschsprung disease, one form
601680	Distal arthrogryposis, type 2B
601690	Platelet-activating factor acetylhydrolase deficiency
601691	Retinitis pigmentosa-19, 601718
601691	Stargardt disease-1, 248200
601691	Cone-rod dystrophy 3
601691	Fundus flavimaculatus with macular dystrophy, 248200
601718	Retinitis pigmentosa-19
601744	Systemic lupus erythematosus, susceptibility to, 1
601757	Rhizomelic chondrodysplasia punctata, type 1, 215100
601769	Osteoporosis, involutional
601769	Rickets, vitamin D-resistant, 277440
601771	Glaucoma 3A, primary infantile, 231300
601780	Ceroid-lipofuscinosis, neuronal-6, variant late infantile
601785	Carbohydrate-deficient glycoprotein syndrome, type I, 212065
601843	Hypothyroidism, congenital, 274400
601844	Pseudohypoaldosteronism type II
601846	Muscular dystrophy with rimmed vacuoles
601850	Retinitis pigmentosa-deafness syndrome
601863	Bare lymphocyte syndrome, complementation group C
601868	Deafness, autosomal dominant 13
601884	[High bone mass]
601885	Cataract, zonular pulverulent-2
601975	Ectodermal dysplasia/skin fragility syndrome
602025	Obesity/hyperinsulinism, susceptibility to
602026	Refsum disease, 266500
602078	Fibrosis of extraocular muscles, congenital, 2
602088	Nephronophthisis, infantile
602094	Lipodystrophy, familial partial
602099	Amyotrophic lateral sclerosis-5
602116	Glioma
602134	Tremor, familial essential, 2
602136	Refsum disease, infantile, 266510
602136	Zellweger syndrome-1, 214100
602136	Adrenoleukodystrophy, neonatal, 202370
602216	Peutz-Jeghers syndrome, 175200

602221	Stem-cell leukemia/lymphoma syndrome
602225	Cone-rod retinal dystrophy-2, 120970
602225	Leber congenital amaurosis, type III
602229	Waardenburg-Shah syndrome, 277580
602235	Epilepsy, benign, neonatal, type 1, 121200
602280	Retinitis pigmentosa-14, 600132
602447	Coronary artery disease, susceptibility to
602475	Ossification of posterior longitudinal ligament of spine
602477	Febrile convulsions, familial, 2
602491	Hyperlipidemia, familial combined, 1
602544	Parkinson disease, juvenile, type 2, 600116
602631	Rhabdomyosarcoma, 268210
602631	Breast Cancer
602716	Nephrosis-1, congenital, Finnish type, 256300
602772	Retinitis pigmentosa-24
602782	Faisalabad histiocytosis
602783	Spastic paraplegia-7

Polynucleotide and Polypeptide Variants

[0113] The present invention is also directed to variants of the reproductive system associated polynucleotide sequence disclosed in SEQ ID NO:X or the complementary strand thereto, nucleotide sequences encoding the polypeptide of SEQ ID NO:Y, the nucleotide sequence of SEQ ID NO:X encoding the polypeptide sequence as defined in column 6 of Table 1A, nucleotide sequences encoding the polypeptide as defined in column 6 of Table 1A, the nucleotide sequence as defined in columns 8 and 9 of Table 2, nucleotide sequences encoding the polypeptide encoded by the nucleotide sequence as defined in columns 8 and 9 of Table 2, the nucleotide sequence as defined in column 6 of Table 1B, nucleotide sequences encoding the polypeptide encoded by the nucleotide sequence as defined in column 6 of Table 1B, the cDNA sequence contained in Clone ID NO:Z, and/or nucleotide sequences encoding a polypeptide encoded by the cDNA sequence contained in Clone ID NO:Z.

[0114] The present invention also encompasses variants of the polypeptide sequence disclosed in SEQ ID NO:Y, a polypeptide sequence as defined in column 6 of Table 1A, a polypeptide sequence encoded by the polynucleotide sequence in SEQ

ID NO:X, a polypeptide sequence encoded by the nucleotide sequence as defined in columns 8 and 9 of Table 2, a polypeptide sequence encoded by the nucleotide sequence as defined in column 6 of Table 1B, a polypeptide sequence encoded by the complement of the polynucleotide sequence in SEQ ID NO:X, and/or a polypeptide sequence encoded by the cDNA sequence contained in Clone ID NO:Z.

[0115] "Variant" refers to a polynucleotide or polypeptide differing from the polynucleotide or polypeptide of the present invention, but retaining essential properties thereof. Generally, variants are overall closely similar, and, in many regions, identical to the polynucleotide or polypeptide of the present invention.

[0116] Thus, one aspect of the invention provides an isolated nucleic acid molecule comprising, or alternatively consisting of, a polynucleotide having a nucleotide sequence selected from the group consisting of: (a) a nucleotide sequence described in SEQ ID NO:X or contained in the cDNA sequence of Clone ID NO:Z; (b) a nucleotide sequence in SEQ ID NO:X or the cDNA in Clone ID NO:Z which encodes a mature reproductive system associated polypeptide; (c) a nucleotide sequence in SEQ ID NO:X or the cDNA sequence of Clone ID NO:Z, which encodes a biologically active fragment of a reproductive system associated polypeptide; (d) a nucleotide sequence in SEQ ID NO:X or the cDNA sequence of Clone ID NO:Z, which encodes an antigenic fragment of a reproductive system associated polypeptide; (e) a nucleotide sequence encoding a reproductive system associated polypeptide having the complete amino acid sequence of SEQ ID NO:Y or the complete amino acid sequence encoded by the cDNA in Clone ID NO:Z; (f) a nucleotide sequence encoding a mature reproductive system associated polypeptide of the amino acid sequence of SEQ ID NO:Y or the amino acid sequence encoded by the cDNA in Clone ID NO:Z; (g) a nucleotide sequence encoding a biologically active fragment of a reproductive system associated polypeptide having the complete amino acid sequence of SEQ ID NO:Y or the complete amino acid sequence encoded by the cDNA in Clone ID NO:Z; (h) a nucleotide sequence encoding an antigenic fragment of a reproductive system associated polypeptide having the complete amino acid sequence of SEQ ID NO:Y or the complete amino acid sequence encoded by the cDNA in Clone ID NO:Z; and (i) a nucleotide sequence complementary to any of the nucleotide sequences in (a), (b), (c), (d), (e), (f), (g), or (h), above.

[0117] The present invention is also directed to nucleic acid molecules which comprise, or alternatively consist of, a nucleotide sequence which is at least 80%, 85%, 90%, 95%, 96%, 97%, 98%, 99% or 100%, identical to, for example, any of the nucleotide sequences in (a), (b), (c), (d), (e), (f), (g), (h), or (i) above, the nucleotide coding sequence in SEQ ID NO:X or the complementary strand thereto, the nucleotide coding sequence of the cDNA contained in Clone ID NO:Z or the complementary strand thereto, a nucleotide sequence encoding the polypeptide of SEQ ID NO:Y, a nucleotide sequence encoding a polypeptide sequence encoded by the nucleotide sequence in SEQ ID NO:X, a polypeptide sequence encoded by the complement of the polynucleotide sequence in SEQ ID NO:X, a nucleotide sequence encoding the polypeptide encoded by the cDNA contained in Clone ID NO:Z, the nucleotide coding sequence in SEQ ID NO:X as defined in columns 8 and 9 of Table 2 or the complementary strand thereto, a nucleotide sequence encoding the polypeptide encoded by the nucleotide sequence in SEQ ID NO:X as defined in columns 8 and 9 of Table 2 or the complementary strand thereto, the nucleotide coding sequence in SEQ ID NO:B as defined in column 6 of Table 1B or the complementary strand thereto, a nucleotide sequence encoding the polypeptide encoded by the nucleotide sequence in SEQ ID NO:B as defined in column 6 of Table 1B or the complementary strand thereto, the nucleotide sequence in SEQ ID NO:X encoding the polypeptide sequence as defined in column 6 of Table 1A or the complementary strand thereto, nucleotide sequences encoding a polypeptide as defined in column 6 of Table 1A or the complementary strand thereto, and/or polynucleotide fragments of any of these nucleic acid molecules (e.g., those fragments described herein). Polynucleotides which hybridize to the complement of these nucleic acid molecules under stringent hybridization conditions or alternatively, under lower stringency conditions, are also encompassed by the invention, as are polypeptides encoded by these polynucleotides and nucleic acids.

[0118] In a preferred embodiment, the invention encompasses nucleic acid molecules which comprise, or alternatively, consist of a polynucleotide which hybridizes under stringent hybridization conditions, or alternatively, under lower stringency conditions, to a polynucleotide in (a), (b), (c), (d), (e), (f), (g), (h), or (i) above, as are polypeptides encoded by these polynucleotides. In another preferred

embodiment, polynucleotides which hybridize to the complement of these nucleic acid molecules under stringent hybridization conditions or alternatively, under lower stringency conditions, are also encompassed by the invention, as are polypeptides encoded by these polynucleotides.

[0119] In another embodiment, the invention provides a purified protein comprising, or alternatively consisting of, a polypeptide having an amino acid sequence selected from the group consisting of: (a) the complete amino acid sequence of SEQ ID NO:Y or the complete amino acid sequence encoded by the cDNA in Clone ID NO:Z; (b) the amino acid sequence of a mature reproductive system associated polypeptide having the amino acid sequence of SEQ ID NO:Y or the amino acid sequence encoded by the cDNA in Clone ID NO:Z; (c) the amino acid sequence of a biologically active fragment of a reproductive system associated polypeptide having the complete amino acid sequence of SEQ ID NO:Y or the complete amino acid sequence encoded by the cDNA in Clone ID NO:Z; and (d) the amino acid sequence of an antigenic fragment of a reproductive system associated polypeptide having the complete amino acid sequence of SEQ ID NO:Y or the complete amino acid sequence encoded by the cDNA in Clone ID NO:Z.

[0120] The present invention is also directed to proteins which comprise, or alternatively consist of, an amino acid sequence which is at least 80%, 85%, 90%, 95%, 96%, 97%, 98%, 99% or 100%, identical to, for example, any of the amino acid sequences in (a), (b), (c), or (d), above, the amino acid sequence shown in SEQ ID NO:Y, the amino acid sequence encoded by the cDNA contained in Clone ID NO:Z, the amino acid sequence of the polypeptide encoded by the nucleotide sequence in SEQ ID NO:X as defined in columns 8 and 9 of Table 2, the amino acid sequence of the polypeptide encoded by the nucleotide sequence in SEQ ID NO:B as defined in column 6 of Table 1B, the amino acid sequence as defined in column 6 of Table 1A, an amino acid sequence encoded by the nucleotide sequence in SEQ ID NO:X, and an amino acid sequence encoded by the complement of the polynucleotide sequence in SEQ ID NO:X. Fragments of these polypeptides are also provided (e.g., those fragments described herein). Further proteins encoded by polynucleotides which hybridize to the complement of the nucleic acid molecules encoding these amino acid sequences under stringent hybridization conditions or alternatively, under lower

stringency conditions, are also encompassed by the invention, as are the polynucleotides encoding these proteins.

[0121] By a nucleic acid having a nucleotide sequence at least, for example, 95% "identical" to a reference nucleotide sequence of the present invention, it is intended that the nucleotide sequence of the nucleic acid is identical to the reference sequence except that the nucleotide sequence may include up to five point mutations per each 100 nucleotides of the reference nucleotide sequence encoding the polypeptide. In other words, to obtain a nucleic acid having a nucleotide sequence at least 95% identical to a reference nucleotide sequence, up to 5% of the nucleotides in the reference sequence may be deleted or substituted with another nucleotide, or a number of nucleotides up to 5% of the total nucleotides in the reference sequence may be inserted into the reference sequence. The query sequence may be an entire sequence referred to in Table 1A or 2 as the ORF (open reading frame), or any fragment specified, as described herein.

[0122] As a practical matter, whether any particular nucleic acid molecule or polypeptide is at least 80%, 85%, 90%, 95%, 96%, 97%, 98% or 99% identical to a nucleotide sequence of the present invention can be determined conventionally using known computer programs. A preferred method for determining the best overall match between a query sequence (a sequence of the present invention) and a subject sequence, also referred to as a global sequence alignment, can be determined using the FASTDB computer program based on the algorithm of Brutlag et al. (Comp. App. Biosci. 6:237-245 (1990)). In a sequence alignment the query and subject sequences are both DNA sequences. An RNA sequence can be compared by converting U's to T's. The result of said global sequence alignment is expressed as percent identity. Preferred parameters used in a FASTDB alignment of DNA sequences to calculate percent identity are: Matrix=Unitary, k-tuple=4, Mismatch Penalty=1, Joining Penalty=30, Randomization Group Length=0, Cutoff Score=1, Gap Penalty=5, Gap Size Penalty 0.05, Window Size=500 or the length of the subject nucleotide sequence, whichever is shorter.

[0123] If the subject sequence is shorter than the query sequence because of 5' or 3' deletions, not because of internal deletions, a manual correction must be made to the results. This is because the FASTDB program does not account for 5' and 3'

truncations of the subject sequence when calculating percent identity. For subject sequences truncated at the 5' or 3' ends, relative to the query sequence, the percent identity is corrected by calculating the number of bases of the query sequence that are 5' and 3' of the subject sequence, which are not matched/aligned, as a percent of the total bases of the query sequence. Whether a nucleotide is matched/aligned is determined by results of the FASTDB sequence alignment. This percentage is then subtracted from the percent identity, calculated by the above FASTDB program using the specified parameters, to arrive at a final percent identity score. This corrected score is what is used for the purposes of the present invention. Only bases outside the 5' and 3' bases of the subject sequence, as displayed by the FASTDB alignment, which are not matched/aligned with the query sequence, are calculated for the purposes of manually adjusting the percent identity score.

[0124] For example, a 90 base subject sequence is aligned to a 100 base query sequence to determine percent identity. The deletions occur at the 5' end of the subject sequence and therefore, the FASTDB alignment does not show a matched/alignment of the first 10 bases at 5' end. The 10 unpaired bases represent 10% of the sequence (number of bases at the 5' and 3' ends not matched/total number of bases in the query sequence) so 10% is subtracted from the percent identity score calculated by the FASTDB program. If the remaining 90 bases were perfectly matched the final percent identity would be 90%. In another example, a 90 base subject sequence is compared with a 100 base query sequence. This time the deletions are internal deletions so that there are no bases on the 5' or 3' of the subject sequence which are not matched/aligned with the query. In this case the percent identity calculated by FASTDB is not manually corrected. Once again, only bases 5' and 3' of the subject sequence which are not matched/aligned with the query sequence are manually corrected for. No other manual corrections are to be made for the purposes of the present invention.

[0125] By a polypeptide having an amino acid sequence at least, for example, 95% "identical" to a query amino acid sequence of the present invention, it is intended that the amino acid sequence of the subject polypeptide is identical to the query sequence except that the subject polypeptide sequence may include up to five amino acid alterations per each 100 amino acids of the query amino acid sequence. In other

words, to obtain a polypeptide having an amino acid sequence at least 95% identical to a query amino acid sequence, up to 5% of the amino acid residues in the subject sequence may be inserted, deleted, (indels) or substituted with another amino acid. These alterations of the reference sequence may occur at the amino or carboxy terminal positions of the reference amino acid sequence or anywhere between those terminal positions, interspersed either individually among residues in the reference sequence or in one or more contiguous groups within the reference sequence.

[0126] As a practical matter, whether any particular polypeptide is at least 80%, 85%, 90%, 95%, 96%, 97%, 98% or 99% identical to, for instance, the amino acid sequence of a polypeptide referred to in Table 1A (e.g., an amino acid sequence identified in columns 5 or 6) or Table 2 (e.g., the amino acid sequence of the polypeptide encoded by the polynucleotide sequence defined in columns 8 and 9 of Table 2) or a fragment thereof, the amino acid sequence of the polypeptide encoded by the polynucleotide sequence in SEQ ID NO:B as defined in column 6 of Table 1B or a fragment thereof, the amino acid sequence of the polypeptide encoded by the nucleotide sequence in SEQ ID NO:X or a fragment thereof, or an amino acid sequence of the polypeptide encoded by cDNA contained in Clone ID NO:Z, or a fragment thereof, can be determined conventionally using known computer programs. A preferred method for determining the best overall match between a query sequence (a sequence of the present invention) and a subject sequence, also referred to as a global sequence alignment, can be determined using the FASTDB computer program based on the algorithm of Brutlag et al. (Comp. App. Biosci.6:237-245 (1990)). In a sequence alignment the query and subject sequences are either both nucleotide sequences or both amino acid sequences. The result of said global sequence alignment is expressed as percent identity. Preferred parameters used in a FASTDB amino acid alignment are: Matrix=PAM 0, k-tuple=2, Mismatch Penalty=1, Joining Penalty=20, Randomization Group Length=0, Cutoff Score=1, Window Size=sequence length, Gap Penalty=5, Gap Size Penalty=0.05, Window Size=500 or the length of the subject amino acid sequence, whichever is shorter.

[0127] If the subject sequence is shorter than the query sequence due to N- or C-terminal deletions, not because of internal deletions, a manual correction must be made to the results. This is because the FASTDB program does not account for N-

and C-terminal truncations of the subject sequence when calculating global percent identity. For subject sequences truncated at the N- and C-termini, relative to the query sequence, the percent identity is corrected by calculating the number of residues of the query sequence that are N- and C-terminal of the subject sequence, which are not matched/aligned with a corresponding subject residue, as a percent of the total bases of the query sequence. Whether a residue is matched/aligned is determined by results of the FASTDB sequence alignment. This percentage is then subtracted from the percent identity, calculated by the above FASTDB program using the specified parameters, to arrive at a final percent identity score. This final percent identity score is what is used for the purposes of the present invention. Only residues to the N- and C-termini of the subject sequence, which are not matched/aligned with the query sequence, are considered for the purposes of manually adjusting the percent identity score. That is, only query residue positions outside the farthest N- and C- terminal residues of the subject sequence.

[0128] For example, a 90 amino acid residue subject sequence is aligned with a 100 residue query sequence to determine percent identity. The deletion occurs at the N-terminus of the subject sequence and therefore, the FASTDB alignment does not show a matching/alignment of the first 10 residues at the N-terminus. The 10 unpaired residues represent 10% of the sequence (number of residues at the N- and C- termini not matched/total number of residues in the query sequence) so 10% is subtracted from the percent identity score calculated by the FASTDB program. If the remaining 90 residues were perfectly matched the final percent identity would be 90%. In another example, a 90 residue subject sequence is compared with a 100 residue query sequence. This time the deletions are internal deletions so there are no residues at the N- or C-termini of the subject sequence which are not matched/aligned with the query. In this case the percent identity calculated by FASTDB is not manually corrected. Once again, only residue positions outside the N- and C-terminal ends of the subject sequence, as displayed in the FASTDB alignment, which are not matched/aligned with the query sequence are manually corrected for. No other manual corrections are to be made for the purposes of the present invention.

[0129] The polynucleotide variants of the invention may contain alterations in the coding regions, non-coding regions, or both. Especially preferred are polynucleotide

variants containing alterations which produce silent substitutions, additions, or deletions, but do not alter the properties or activities of the encoded polypeptide. Nucleotide variants produced by silent substitutions due to the degeneracy of the genetic code are preferred. Moreover, polypeptide variants in which less than 50, less than 40, less than 30, less than 20, less than 10, or 5-50, 5-25, 5-10, 1-5, or 1-2 amino acids are substituted, deleted, or added in any combination are also preferred. Polynucleotide variants can be produced for a variety of reasons, e.g., to optimize codon expression for a particular host (change codons in the human mRNA to those preferred by a bacterial host such as *E. coli*).

[0130] Naturally occurring variants are called "allelic variants," and refer to one of several alternate forms of a gene occupying a given locus on a chromosome of an organism. (Genes II, Lewin, B., ed., John Wiley & Sons, New York (1985).) These allelic variants can vary at either the polynucleotide and/or polypeptide level and are included in the present invention. Alternatively, non-naturally occurring variants may be produced by mutagenesis techniques or by direct synthesis.

[0131] Using known methods of protein engineering and recombinant DNA technology, variants may be generated to improve or alter the characteristics of the polypeptides of the present invention. For instance, one or more amino acids can be deleted from the N-terminus or C-terminus of the polypeptides of the present invention without substantial loss of biological function. As an example, the authors of Ron et al., J. Biol. Chem. 268: 2984-2988 (1993), reported variant KGF proteins having heparin binding activity even after deleting 3, 8, or 27 amino-terminal amino acid residues. Similarly, Interferon gamma exhibited up to ten times higher activity after deleting 8-10 amino acid residues from the carboxy terminus of this protein. (Dobeli et al., J. Biotechnology 7:199-216 (1988).)

[0132] Moreover, ample evidence demonstrates that variants often retain a biological activity similar to that of the naturally occurring protein. For example, Gayle and coworkers (J. Biol. Chem. 268:22105-22111 (1993)) conducted extensive mutational analysis of human cytokine IL-1a. They used random mutagenesis to generate over 3,500 individual IL-1a mutants that averaged 2.5 amino acid changes per variant over the entire length of the molecule. Multiple mutations were examined at every possible amino acid position. The investigators found that "[m]ost of the

molecule could be altered with little effect on either [binding or biological activity]." In fact, only 23 unique amino acid sequences, out of more than 3,500 nucleotide sequences examined, produced a protein that significantly differed in activity from wild-type.

[0133] Furthermore, even if deleting one or more amino acids from the N-terminus or C-terminus of a polypeptide results in modification or loss of one or more biological functions, other biological activities may still be retained. For example, the ability of a deletion variant to induce and/or to bind antibodies which recognize the secreted form will likely be retained when less than the majority of the residues of the secreted form are removed from the N-terminus or C-terminus. Whether a particular polypeptide lacking N- or C-terminal residues of a protein retains such immunogenic activities can readily be determined by routine methods described herein and otherwise known in the art.

[0134] Thus, the invention further includes polypeptide variants which show a functional activity (e.g., biological activity) of the polypeptides of the invention. Such variants include deletions, insertions, inversions, repeats, and substitutions selected according to general rules known in the art so as have little effect on activity.

[0135] The present application is directed to nucleic acid molecules at least 80%, 85%, 90%, 95%, 96%, 97%, 98%, 99% or 100% identical to the nucleic acid sequences disclosed herein, (e.g., encoding a polypeptide having the amino acid sequence of an N and/or C terminal deletion), irrespective of whether they encode a polypeptide having functional activity. This is because even where a particular nucleic acid molecule does not encode a polypeptide having functional activity, one of skill in the art would still know how to use the nucleic acid molecule, for instance, as a hybridization probe or a polymerase chain reaction (PCR) primer. Uses of the nucleic acid molecules of the present invention that do not encode a polypeptide having functional activity include, *inter alia*, (1) isolating a gene or allelic or splice variants thereof in a cDNA library; (2) in situ hybridization (e.g., "FISH") to metaphase chromosomal spreads to provide precise chromosomal location of the gene, as described in Verma et al., Human Chromosomes: A Manual of Basic Techniques, Pergamon Press, New York (1988); (3) Northern Blot analysis for detecting mRNA expression in specific tissues (e.g., normal reproductive system tissues or diseased

reproductive system tissues); and (4) *in situ* hybridization (e.g., histochemistry) for detecting mRNA expression in specific tissues (e.g., normal reproductive system tissues or diseased reproductive system tissues).

[0136] Preferred, however, are nucleic acid molecules having sequences at least 80%, 85%, 90%, 95%, 96%, 97%, 98%, 99% or 100% identical to the nucleic acid sequences disclosed herein, which do, in fact, encode a polypeptide having functional activity. By a polypeptide having "functional activity" is meant, a polypeptide capable of displaying one or more known functional activities associated with a full-length (complete) protein of the invention. Such functional activities include, but are not limited to, biological activity, antigenicity [ability to bind (or compete with a polypeptide of the invention for binding) to an anti-polypeptide of the invention antibody], immunogenicity (ability to generate antibody which binds to a specific polypeptide of the invention), ability to form multimers with polypeptides of the invention, and ability to bind to a receptor or ligand for a polypeptide of the invention.

[0137] The functional activity of the polypeptides, and fragments, variants and derivatives of the invention, can be assayed by various methods.

[0138] For example, in one embodiment where one is assaying for the ability to bind or compete with full-length polypeptide of the present invention for binding to an anti-polypeptide of the invention antibody, various immunoassays known in the art can be used, including but not limited to, competitive and non-competitive assay systems using techniques such as radioimmunoassays, ELISA (enzyme linked immunosorbent assay), "sandwich" immunoassays, immunoradiometric assays, gel diffusion precipitation reactions, immunodiffusion assays, *in situ* immunoassays (using colloidal gold, enzyme or radioisotope labels, for example), western blots, precipitation reactions, agglutination assays (e.g., gel agglutination assays, hemagglutination assays), complement fixation assays, immunofluorescence assays, protein A assays, and immunoelectrophoresis assays, etc. In one embodiment, antibody binding is detected by detecting a label on the primary antibody. In another embodiment, the primary antibody is detected by detecting binding of a secondary antibody or reagent to the primary antibody. In a further embodiment, the secondary antibody is labeled. Many means are known in the art for detecting binding in an immunoassay and are within the scope of the present invention.

[0139] In another embodiment, where a ligand is identified, or the ability of a polypeptide fragment, variant or derivative of the invention to multimerize is being evaluated, binding can be assayed, e.g., by means well-known in the art, such as, for example, reducing and non-reducing gel chromatography, protein affinity chromatography, and affinity blotting. See generally, Phizicky et al., *Microbiol. Rev.* 59:94-123 (1995). In another embodiment, the ability of physiological correlates of a polypeptide of the present invention to bind to a substrate(s) of the polypeptide of the invention can be routinely assayed using techniques known in the art.

[0140] In addition, assays described herein (see Examples) and otherwise known in the art may routinely be applied to measure the ability of polypeptides of the present invention and fragments, variants and derivatives thereof to elicit polypeptide related biological activity (either *in vitro* or *in vivo*). Other methods will be known to the skilled artisan and are within the scope of the invention.

[0141] Of course, due to the degeneracy of the genetic code, one of ordinary skill in the art will immediately recognize that a large number of the nucleic acid molecules having a sequence at least 80%, 85%, 90%, 95%, 96%, 97%, 98%, 99%, or 100% identical to, for example, the nucleic acid sequence of the cDNA contained in Clone ID NO:Z, a nucleic acid sequence referred to in Table 1A (e.g., SEQ ID NO:X), a nucleic acid sequence disclosed in Table 2 (e.g., the nucleic acid sequence delineated in columns 8 and 9) or fragments thereof, will encode polypeptides "having functional activity." In fact, since degenerate variants of any of these nucleotide sequences all encode the same polypeptide, in many instances, this will be clear to the skilled artisan even without performing the above described comparison assay. It will be further recognized in the art that, for such nucleic acid molecules that are not degenerate variants, a reasonable number will also encode a polypeptide having functional activity. This is because the skilled artisan is fully aware of amino acid substitutions that are either less likely or not likely to significantly effect protein function (e.g., replacing one aliphatic amino acid with a second aliphatic amino acid), as further described below.

[0142] For example, guidance concerning how to make phenotypically silent amino acid substitutions is provided in Bowie et al., "Deciphering the Message in Protein Sequences: Tolerance to Amino Acid Substitutions," *Science* 247:1306-1310

(1990), wherein the authors indicate that there are two main strategies for studying the tolerance of an amino acid sequence to change.

[0143] The first strategy exploits the tolerance of amino acid substitutions by natural selection during the process of evolution. By comparing amino acid sequences in different species, conserved amino acids can be identified. These conserved amino acids are likely important for protein function. In contrast, the amino acid positions where substitutions have been tolerated by natural selection indicates that these positions are not critical for protein function. Thus, positions tolerating amino acid substitution could be modified while still maintaining biological activity of the protein.

[0144] The second strategy uses genetic engineering to introduce amino acid changes at specific positions of a cloned gene to identify regions critical for protein function. For example, site directed mutagenesis or alanine-scanning mutagenesis (introduction of single alanine mutations at every residue in the molecule) can be used. See Cunningham et al., Science 244:1081-1085 (1989). The resulting mutant molecules can then be tested for biological activity.

[0145] As the authors state, these two strategies have revealed that proteins are surprisingly tolerant of amino acid substitutions. The authors further indicate which amino acid changes are likely to be permissive at certain amino acid positions in the protein. For example, most buried (within the tertiary structure of the protein) amino acid residues require nonpolar side chains, whereas few features of surface side chains are generally conserved. Moreover, tolerated conservative amino acid substitutions involve replacement of the aliphatic or hydrophobic amino acids Ala, Val, Leu and Ile; replacement of the hydroxyl residues Ser and Thr; replacement of the acidic residues Asp and Glu; replacement of the amide residues Asn and Gln, replacement of the basic residues Lys, Arg, and His; replacement of the aromatic residues Phe, Tyr, and Trp, and replacement of the small-sized amino acids Ala, Ser, Thr, Met, and Gly. Besides conservative amino acid substitutions, variants of the present invention include (i) substitutions with one or more of the non-conserved amino acid residues, where the substituted amino acid residues may or may not be one encoded by the genetic code, or (ii) substitutions with one or more of the amino acid residues having a substituent group, or (iii) fusion of the mature polypeptide with another compound, such as a compound to increase the stability and/or solubility of the polypeptide (for example,

polyethylene glycol), or (iv) fusion of the polypeptide with additional amino acids, such as, for example, an IgG Fc fusion region peptide, serum albumin (preferably human serum albumin) or a fragment or variant thereof, or leader or secretory sequence, or a sequence facilitating purification. Such variant polypeptides are deemed to be within the scope of those skilled in the art from the teachings herein.

[0146] For example, polypeptide variants containing amino acid substitutions of charged amino acids with other charged or neutral amino acids may produce proteins with improved characteristics, such as less aggregation. Aggregation of pharmaceutical formulations both reduces activity and increases clearance due to the aggregate's immunogenic activity. See Pinckard et al., Clin. Exp. Immunol. 2:331-340 (1967); Robbins et al., Diabetes 36: 838-845 (1987); Cleland et al., Crit. Rev. Therapeutic Drug Carrier Systems 10:307-377 (1993).

[0147] A further embodiment of the invention relates to polypeptides which comprise the amino acid sequence of a polypeptide having an amino acid sequence which contains at least one amino acid substitution, but not more than 50 amino acid substitutions, even more preferably, not more than 40 amino acid substitutions, still more preferably, not more than 30 amino acid substitutions, and still even more preferably, not more than 20 amino acid substitutions from a polypeptide sequence disclosed herein. Of course it is highly preferable for a polypeptide to have an amino acid sequence which comprises the amino acid sequence of a polypeptide of SEQ ID NO:Y, an amino acid sequence encoded by SEQ ID NO:X, an amino acid sequence encoded by the portion of SEQ ID NO:X as defined in columns 8 and 9 of Table 2, an amino acid sequence encoded by the complement of SEQ ID NO:X, and/or the amino acid sequence encoded by cDNA contained in Clone ID NO:Z which contains, in order of ever-increasing preference, at least one, but not more than 10, 9, 8, 7, 6, 5, 4, 3, 2 or 1 amino acid substitutions.

[0148] In specific embodiments, the polypeptides of the invention comprise, or alternatively, consist of, fragments or variants of a reference amino acid sequence selected from: (a) the amino acid sequence of SEQ ID NO:Y or fragments thereof (e.g., the mature form and/or other fragments described herein); (b) the amino acid sequence encoded by SEQ ID NO:X or fragments thereof; (c) the amino acid sequence encoded by the complement of SEQ ID NO:X or fragments thereof; (d) the amino acid

sequence encoded by the portion of SEQ ID NO:X as defined in columns 8 and 9 of Table 2 or fragments thereof; and (e) the amino acid sequence encoded by cDNA contained in Clone ID NO:Z or fragments thereof; wherein the fragments or variants have 1-5, 5-10, 5-25, 5-50, 10-50 or 50-150, amino acid residue additions, substitutions, and/or deletions when compared to the reference amino acid sequence. In preferred embodiments, the amino acid substitutions are conservative. Polynucleotides encoding these polypeptides are also encompassed by the invention.

Polynucleotide and Polypeptide Fragments

[0149] The present invention is also directed to polynucleotide fragments of the polynucleotides (nucleic acids) of the invention. In the present invention, a "polynucleotide fragment" refers to a polynucleotide having a nucleic acid sequence which, for example: is a portion of the cDNA contained in Clone ID NO:Z or the complementary strand thereto; is a portion of the polynucleotide sequence encoding the polypeptide encoded by the cDNA contained in Clone ID NO:Z or the complementary strand thereto; is a portion of a polynucleotide sequence encoding the amino acid sequence encoded by the region of SEQ ID NO:X as defined in columns 8 and 9 of Table 2 or the complementary strand thereto; is a portion of the polynucleotide sequence of SEQ ID NO:X as defined in columns 8 and 9 of Table 2 or the complementary strand thereto; is a portion of the polynucleotide sequence in SEQ ID NO:X or the complementary strand thereto; is a polynucleotide sequence encoding a portion of the polypeptide of SEQ ID NO:Y; is a polynucleotide sequence encoding a portion of a polypeptide encoded by SEQ ID NO:X; is a polynucleotide sequence encoding a portion of a polypeptide encoded by the complement of the polynucleotide sequence in SEQ ID NO:X; is a portion of a polynucleotide sequence encoding the amino acid sequence encoded by the region of SEQ ID NO:B as defined in column 6 of Table 1B or the complementary strand thereto; or is a portion of the polynucleotide sequence of SEQ ID NO:B as defined in column 6 of Table 1B or the complementary strand thereto.

[0150] The polynucleotide fragments of the invention are preferably at least about 15 nt, and more preferably at least about 20 nt, still more preferably at least about 30 nt, and even more preferably, at least about 40 nt, at least about 50 nt, at least about 75

nt, or at least about 150 nt in length. A fragment "at least 20 nt in length," for example, is intended to include 20 or more contiguous bases from the cDNA sequence contained in Clone ID NO:Z, or the nucleotide sequence shown in SEQ ID NO:X or the complementary strand thereto. In this context "about" includes the particularly recited value or a value larger or smaller by several (5, 4, 3, 2, or 1) nucleotides, at either terminus or at both termini. These nucleotide fragments have uses that include, but are not limited to, as diagnostic probes and primers as discussed herein. Of course, larger fragments (e.g., at least 160, 170, 180, 190, 200, 250, 500, 600, 1000, or 2000 nucleotides in length) are also encompassed by the invention.

[0151] Moreover, representative examples of polynucleotide fragments of the invention, comprise, or alternatively consist of, a sequence from about nucleotide number 1-50, 51-100, 101-150, 151-200, 201-250, 251-300, 301-350, 351-400, 401-450, 451-500, 501-550, 551-600, 651-700, 701-750, 751-800, 800-850, 851-900, 901-950, 951-1000, 1001-1050, 1051-1100, 1101-1150, 1151-1200, 1201-1250, 1251-1300, 1301-1350, 1351-1400, 1401-1450, 1451-1500, 1501-1550, 1551-1600, 1601-1650, 1651-1700, 1701-1750, 1751-1800, 1801-1850, 1851-1900, 1901-1950, 1951-2000, 2001-2050, 2051-2100, 2101-2150, 2151-2200, 2201-2250, 2251-2300, 2301-2350, 2351-2400, 2401-2450, 2451-2500, 2501-2550, 2551-2600, 2601-2650, 2651-2700, 2701-2750, 2751-2800, 2801-2850, 2851-2900, 2901-2950, 2951-3000, 3001-3050, 3051-3100, 3101-3150, 3151-3200, 3201-3250, 3251-3300, 3301-3350, 3351-3400, 3401-3450, 3451-3500, 3501-3550, 3551-3600, 3601-3650, 3651-3700, 3701-3750, 3751-3800, 3801-3850, 3851-3900, 3901-3950, 3951-4000, 4001-4050, 4051-4100, 4101-4150, 4151-4200, 4201-4250, 4251-4300, 4301-4350, 4351-4400, 4401-4450, 4451-4500, 4501-4550, 4551-4600, 4601-4650, 4651-4700, 4701-4750, 4751-4800, 4801-4850, 4851-4900, 4901-4950, 4951-5000, 5001-5050, 5051-5100, 5101-5150, 5151-5200, 5201-5250, 5251-5300, 5301-5350, 5351-5400, 5401-5450, 5451-5500, 5501-5550, 5551-5600, 5601-5650, 5651-5700, 5701-5750, 5751-5800, 5801-5850, 5851-5900, 5901-5950, 5951-6000, 6001-6050, 6051-6100, 6101-6150, 6151-6200, 6201-6250, 6251-6300, 6301-6350, 6351-6400, 6401-6450, 6451-6500, 6501-6550, 6551-6600, 6601-6650, 6651-6700, 6701-6750, 6751-6800, 6801-6850, 6851-6900, 6901-6950, 6951-7000, 7001-7050, 7051-7100, 7101-7150, 7151-7200, 7201-7250, 7251-7300 or 7301 to the end of SEQ ID NO:X, or the complementary strand

thereto. In this context "about" includes the particularly recited range or a range larger or smaller by several (5, 4, 3, 2, or 1) nucleotides, at either terminus or at both termini. Preferably, these fragments encode a polypeptide which has a functional activity (e.g., biological activity). More preferably, these polynucleotides can be used as probes or primers as discussed herein. Polynucleotides which hybridize to one or more of these polynucleotides under stringent hybridization conditions or alternatively, under lower stringency conditions are also encompassed by the invention, as are polypeptides encoded by these polynucleotides.

[0152] Further representative examples of polynucleotide fragments of the invention, comprise, or alternatively consist of, a sequence from about nucleotide number 1-50, 51-100, 101-150, 151-200, 201-250, 251-300, 301-350, 351-400, 401-450, 451-500, 501-550, 551-600, 651-700, 701-750, 751-800, 800-850, 851-900, 901-950, 951-1000, 1001-1050, 1051-1100, 1101-1150, 1151-1200, 1201-1250, 1251-1300, 1301-1350, 1351-1400, 1401-1450, 1451-1500, 1501-1550, 1551-1600, 1601-1650, 1651-1700, 1701-1750, 1751-1800, 1801-1850, 1851-1900, 1901-1950, 1951-2000, 2001-2050, 2051-2100, 2101-2150, 2151-2200, 2201-2250, 2251-2300, 2301-2350, 2351-2400, 2401-2450, 2451-2500, 2501-2550, 2551-2600, 2601-2650, 2651-2700, 2701-2750, 2751-2800, 2801-2850, 2851-2900, 2901-2950, 2951-3000, 3001-3050, 3051-3100, 3101-3150, 3151-3200, 3201-3250, 3251-3300, 3301-3350, 3351-3400, 3401-3450, 3451-3500, 3501-3550, 3551-3600, 3601-3650, 3651-3700, 3701-3750, 3751-3800, 3801-3850, 3851-3900, 3901-3950, 3951-4000, 4001-4050, 4051-4100, 4101-4150, 4151-4200, 4201-4250, 4251-4300, 4301-4350, 4351-4400, 4401-4450, 4451-4500, 4501-4550, 4551-4600, 4601-4650, 4651-4700, 4701-4750, 4751-4800, 4801-4850, 4851-4900, 4901-4950, 4951-5000, 5001-5050, 5051-5100, 5101-5150, 5151-5200, 5201-5250, 5251-5300, 5301-5350, 5351-5400, 5401-5450, 5451-5500, 5501-5550, 5551-5600, 5601-5650, 5651-5700, 5701-5750, 5751-5800, 5801-5850, 5851-5900, 5901-5950, 5951-6000, 6001-6050, 6051-6100, 6101-6150, 6151-6200, 6201-6250, 6251-6300, 6301-6350, 6351-6400, 6401-6450, 6451-6500, 6501-6550, 6551-6600, 6601-6650, 6651-6700, 6701-6750, 6751-6800, 6801-6850, 6851-6900, 6901-6950, 6951-7000, 7001-7050, 7051-7100, 7101-7150, 7151-7200, 7201-7250, 7251-7300 or 7301 to the end of the cDNA sequence contained in Clone ID NO:Z, or the complementary strand thereto. In this context "about" includes the

particularly recited range or a range larger or smaller by several (5, 4, 3, 2, or 1) nucleotides, at either terminus or at both termini. Preferably, these fragments encode a polypeptide which has a functional activity (e.g., biological activity). More preferably, these polynucleotides can be used as probes or primers as discussed herein. Polynucleotides which hybridize to one or more of these polynucleotides under stringent hybridization conditions or alternatively, under lower stringency conditions are also encompassed by the invention, as are polypeptides encoded by these polynucleotides.

[0153] Moreover, representative examples of polynucleotide fragments of the invention comprise, or alternatively consist of, a nucleic acid sequence comprising one, two, three, four, five, six, seven, eight, nine, ten, or more of the above described polynucleotide fragments of the invention in combination with a polynucleotide sequence delineated in Table 1B column 6. Additional, representative examples of polynucleotide fragments of the invention comprise, or alternatively consist of, a nucleic acid sequence comprising one, two, three, four, five, six, seven, eight, nine, ten, or more of the above described polynucleotide fragments of the invention in combination with a polynucleotide sequence that is the complementary strand of a sequence delineated in column 6 of Table 1B. In further embodiments, the above-described polynucleotide fragments of the invention comprise, or alternatively consist of, sequences delineated in Table 1B, column 6, and have a nucleic acid sequence which is different from that of the BAC fragment having the sequence disclosed in SEQ ID NO:B (see Table 1B, column 5). In additional embodiments, the above-described polynucleotide fragments of the invention comprise, or alternatively consist of, sequences delineated in Table 1B, column 6, and have a nucleic acid sequence which is different from that published for the BAC clone identified as BAC ID NO:A (see Table 1B, column 4). In additional embodiments, the above-described polynucleotides of the invention comprise, or alternatively consist of, sequences delineated Table 1B, column 6, and have a nucleic acid sequence which is different from that contained in the BAC clone identified as BAC ID NO:A (see Table 1B, column 4). Polypeptides encoded by these polynucleotides, other polynucleotides that encode these polypeptides, and antibodies that bind these polypeptides are also

encompassed by the invention. Additionally, fragments and variants of the above-described polynucleotides and polypeptides are also encompassed by the invention.

[0154] In additional specific embodiments, polynucleotides of the invention comprise, or alternatively consist of, one, two, three, four, five, six, seven, eight, nine, ten, or more fragments of the sequences delineated in column 6 of Table 1B, and the polynucleotide sequence of SEQ ID NO:X (e.g., as defined in Table 1B, column 2) or fragments or variants thereof. Polypeptides encoded by these polynucleotides, other polynucleotides that encode these polypeptides, and antibodies that bind these polypeptides are also encompassed by the invention.

[0155] In additional specific embodiments, polynucleotides of the invention comprise, or alternatively consist of, one, two, three, four, five, six, seven, eight, nine, ten, or more fragments of the sequences delineated in column 6 of Table 1B which correspond to the same Clone ID NO:Z (see Table 1B, column 1), and the polynucleotide sequence of SEQ ID NO:X (e.g., as defined in Table 1A or 1B) or fragments or variants thereof. Polypeptides encoded by these polynucleotides, other polynucleotides that encode these polypeptides, and antibodies that bind these polypeptides are also encompassed by the invention.

[0156] In further specific embodiments, polynucleotides of the invention comprise, or alternatively consist of, one, two, three, four, five, six, seven, eight, nine, ten, or more fragments of the sequences delineated in the same row of column 6 of Table 1B, and the polynucleotide sequence of SEQ ID NO:X (e.g., as defined in Table 1A or 1B) or fragments or variants thereof. Polypeptides encoded by these polynucleotides, other polynucleotides that encode these polypeptides, and antibodies that bind these polypeptides are also encompassed by the invention.

[0157] In additional specific embodiments, polynucleotides of the invention comprise, or alternatively consist of a polynucleotide sequence in which the 3' 10 polynucleotides of one of the sequences delineated in column 6 of Table 1B and the 5' 10 polynucleotides of the sequence of SEQ ID NO:X are directly contiguous. Nucleic acids which hybridize to the complement of these 20 contiguous polynucleotides under stringent hybridization conditions or alternatively, under lower stringency conditions, are also encompassed by the invention. Polypeptides encoded by these polynucleotides and/or nucleic acids, other polynucleotides and/or nucleic acids that

encode these polypeptides, and antibodies that bind these polypeptides are also encompassed by the invention. Additionally, fragments and variants of the above-described polynucleotides, nucleic acids, and polypeptides are also encompassed by the invention.

[0158] In additional specific embodiments, polynucleotides of the invention comprise, or alternatively consist of a polynucleotide sequence in which the 3' 10 polynucleotides of one of the sequences delineated in column 6 of Table 1B and the 5' 10 polynucleotides of a fragment or variant of the sequence of SEQ ID NO:X (e.g., as described herein) are directly contiguous. Nucleic acids which hybridize to the complement of these 20 contiguous polynucleotides under stringent hybridization conditions or alternatively, under lower stringency conditions, are also encompassed by the invention. Polypeptides encoded by these polynucleotides and/or nucleic acids, other polynucleotides and/or nucleic acids encoding these polypeptides, and antibodies that bind these polypeptides are also encompassed by the invention. Additionally, fragments and variants of the above-described polynucleotides, nucleic acids, and polypeptides are also encompassed by the invention.

[0159] In further specific embodiments, polynucleotides of the invention comprise, or alternatively consist of a polynucleotide sequence in which the 3' 10 polynucleotides of a fragment or variant of the sequence of SEQ ID NO:X and the 5' 10 polynucleotides of the sequence of one of the sequences delineated in column 6 of Table 1B are directly contiguous. Nucleic acids which hybridize to the complement of these 20 contiguous polynucleotides under stringent hybridization conditions or alternatively, under lower stringency conditions, are also encompassed by the invention. Polypeptides encoded by these polynucleotides and/or nucleic acids, other polynucleotides and/or nucleic acids encoding these polypeptides, and antibodies that bind these polypeptides are also encompassed by the invention. Additionally, fragments and variants of the above-described polynucleotides, nucleic acids, and polypeptides are also encompassed by the invention.

[0160] In specific embodiments, polynucleotides of the invention comprise, or alternatively consist of a polynucleotide sequence in which the 3' 10 polynucleotides of one of the sequences delineated in column 6 of Table 1B and the 5' 10 polynucleotides of another sequence in column 6 are directly contiguous. In preferred

embodiments, the 3' 10 polynucleotides of one of the sequences delineated in column 6 of Table 1B is directly contiguous with the 5' 10 polynucleotides of the next sequential exon delineated in Table 1B, column 6. Nucleic acids which hybridize to the complement of these 20 contiguous polynucleotides under stringent hybridization conditions or alternatively, under lower stringency conditions, are also encompassed by the invention. Polypeptides encoded by these polynucleotides and/or nucleic acids, other polynucleotides and/or nucleic acids encoding these polypeptides, and antibodies that bind these polypeptides are also encompassed by the invention. Additionally, fragments and variants of the above-described polynucleotides, nucleic acids, and polypeptides are also encompassed by the invention.

[0161] In the present invention, a "polypeptide fragment" refers to an amino acid sequence which is a portion of that contained in SEQ ID NO:Y, a portion of an amino acid sequence encoded by the portion of SEQ ID NO:X as defined in columns 8 and 9 of Table 2, a portion of an amino acid sequence encoded by the polynucleotide sequence of SEQ ID NO:X, a portion of an amino acid sequence encoded by the complement of the polynucleotide sequence in SEQ ID NO:X, and/or a portion of an amino acid sequence encoded by the cDNA contained in Clone ID NO:Z. Protein (polypeptide) fragments may be "free-standing," or comprised within a larger polypeptide of which the fragment forms a part or region, most preferably as a single continuous region. Representative examples of polypeptide fragments of the invention, include, for example, fragments comprising, or alternatively consisting of, from about amino acid number 1-20, 21-40, 41-60, 61-80, 81-100, 102-120, 121-140, 141-160, 161-180, 181-200, 201-220, 221-240, 241-260, 261-280, 281-300, 301-320, 321-340, 341-360, 361-380, 381-400, 401-420, 421-440, 441-460, 461-480, 481-500, 501-520, 521-540, 541-560, 561-580, 581-600, 601-620, 621-640, 641-660, 661-680, 681-700, 701-720, 721-740, 741-760, 761-780, 781-800, 801-820, 821-840, 841-860, 861-880, 881-900, 901-920, 921-940, 941-960, 961-980, 981-1000, 1001-1020, 1021-1040, 1041-1060, 1061-1080, 1081-1100, 1101-1120, 1121-1140, 1141-1160, 1161-1180, 1181-1200, 1201-1220, 1221-1240, 1241-1260, 1261-1280, 1281-1300, 1301-1320, 1321-1340, 1341-1360, 1361-1380, 1381-1400, 1401-1420, 1421-1440, or 1441 to the end of the coding region. In a preferred embodiment, polypeptide fragments of the invention include, for example, fragments comprising, or alternatively consisting

of, from about amino acid number 1-20, 21-40, 41-60, 61-80, 81-100, 102-120, 121-140, 141-160, 161-180, 181-200, 201-220, 221-240, 241-260, 261-280, 281-300, 301-320, 321-340, 341-360, 361-380, 381-400, 401-420, 421-440, 441-460, 461-480, 481-500, 501-520, 521-540, 541-560, 561-580, 581-600, 601-620, 621-640, 641-660, 661-680, 681-700, 701-720, 721-740, 741-760, 761-780, 781-800, 801-820, 821-840, 841-860, 861-880, 881-900, 901-920, 921-940, 941-960, 961-980, 981-1000, 1001-1020, 1021-1040, 1041-1060, 1061-1080, 1081-1100, 1101-1120, 1121-1140, 1141-1160, 1161-1180, 1181-1200, 1201-1220, 1221-1240, 1241-1260, 1261-1280, 1281-1300, 1301-1320, 1321-1340, 1341-1360, 1361-1380, 1381-1400, 1401-1420, 1421-1440, or 1441 to the end of the coding region of SEQ ID NO:Y. Moreover, polypeptide fragments of the invention may be at least about 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 100, 110, 120, 130, 140, or 150 amino acids in length. In this context "about" includes the particularly recited ranges or values, or ranges or values larger or smaller by several (5, 4, 3, 2, or 1) amino acids, at either extreme or at both extremes. Polynucleotides encoding these polypeptide fragments are also encompassed by the invention.

[0162] Even if deletion of one or more amino acids from the N-terminus of a protein results in modification or loss of one or more biological functions of the protein, other functional activities (e.g., biological activities, ability to multimerize, ability to bind a ligand) may still be retained. For example, the ability of shortened muteins to induce and/or bind to antibodies which recognize the complete or mature forms of the polypeptides generally will be retained when less than the majority of the residues of the complete or mature polypeptide are removed from the N-terminus. Whether a particular polypeptide lacking N-terminal residues of a complete polypeptide retains such immunologic activities can readily be determined by routine methods described herein and otherwise known in the art. It is not unlikely that a mutein with a large number of deleted N-terminal amino acid residues may retain some biological or immunogenic activities. In fact, peptides composed of as few as six amino acid residues may often evoke an immune response.

[0163] Accordingly, polypeptide fragments include the secreted protein as well as the mature form. Further preferred polypeptide fragments include the secreted protein or the mature form having a continuous series of deleted residues from the amino or

the carboxy terminus, or both. For example, any number of amino acids, ranging from 1-60, can be deleted from the amino terminus of either the secreted polypeptide or the mature form. Similarly, any number of amino acids, ranging from 1-30, can be deleted from the carboxy terminus of the secreted protein or mature form. Furthermore, any combination of the above amino and carboxy terminus deletions is preferred. Similarly, polynucleotides encoding these polypeptide fragments are also preferred.

[0164] The present invention further provides polypeptides having one or more residues deleted from the amino terminus of the amino acid sequence of a polypeptide disclosed herein (e.g., a polypeptide of SEQ ID NO:Y, a polypeptide encoded by the polynucleotide sequence contained in SEQ ID NO:X or the complement thereof, a polypeptide encoded by the portion of SEQ ID NO:X as defined in columns 8 and 9 of Table 2, a polypeptide encoded by the portion of SEQ ID NO:B as defined in column 6 of Table 1B, and/or a polypeptide encoded by the cDNA contained in Clone ID NO:Z). In particular, N-terminal deletions may be described by the general formula m-q, where q is a whole integer representing the total number of amino acid residues in a polypeptide of the invention (e.g., the polypeptide disclosed in SEQ ID NO:Y, or the polypeptide encoded by the portion of SEQ ID NO:X as defined in columns 8 and 9 of Table 2), and m is defined as any integer ranging from 2 to q-6. Polynucleotides encoding these polypeptides are also encompassed by the invention.

[0165] The present invention further provides polypeptides having one or more residues from the carboxy terminus of the amino acid sequence of a polypeptide disclosed herein (e.g., a polypeptide of SEQ ID NO:Y, a polypeptide encoded by the polynucleotide sequence contained in SEQ ID NO:X, a polypeptide encoded by the portion of SEQ ID NO:X as defined in columns 8 and 9 of Table 2, and/or a polypeptide encoded by the cDNA contained in Clone ID NO:Z). In particular, C-terminal deletions may be described by the general formula 1-n, where n is any whole integer ranging from 6 to q-1, and where n corresponds to the position of amino acid residue in a polypeptide of the invention. Polynucleotides encoding these polypeptides are also encompassed by the invention.

[0166] In addition, any of the above described N- or C-terminal deletions can be combined to produce a N- and C-terminal deleted polypeptide. The invention also

provides polypeptides having one or more amino acids deleted from both the amino and the carboxyl termini, which may be described generally as having residues m-n of a polypeptide encoded by SEQ ID NO:X (e.g., including, but not limited to, the preferred polypeptide disclosed as SEQ ID NO:Y and the polypeptide encoded by the portion of SEQ ID NO:X as defined in columns 8 and 9 of Table 2), the cDNA contained in Clone ID NO:Z, and/or the complement thereof, where n and m are integers as described above. Polynucleotides encoding these polypeptides are also encompassed by the invention.

[0167] Also as mentioned above, even if deletion of one or more amino acids from the C-terminus of a protein results in modification of loss of one or more biological functions of the protein, other functional activities (e.g., biological activities, ability to multimerize, ability to bind a ligand) may still be retained. For example the ability of the shortened mutein to induce and/or bind to antibodies which recognize the complete or mature forms of the polypeptide generally will be retained when less than the majority of the residues of the complete or mature polypeptide are removed from the C-terminus. Whether a particular polypeptide lacking C-terminal residues of a complete polypeptide retains such immunologic activities can readily be determined by routine methods described herein and otherwise known in the art. It is not unlikely that a mutein with a large number of deleted C-terminal amino acid residues may retain some biological or immunogenic activities. In fact, peptides composed of as few as six amino acid residues may often evoke an immune response.

[0168] The present application is also directed to proteins containing polypeptides at least 80%, 85%, 90%, 95%, 96%, 97%, 98% or 99% identical to a polypeptide sequence set forth herein. In preferred embodiments, the application is directed to proteins containing polypeptides at least 80%, 85%, 90%, 95%, 96%, 97%, 98% or 99% identical to polypeptides having the amino acid sequence of the specific N- and C-terminal deletions. Polynucleotides encoding these polypeptides are also encompassed by the invention.

[0169] Any polypeptide sequence encoded by, for example, the polynucleotide sequences set forth as SEQ ID NO:X or the complement thereof, (presented, for example, in Tables 1A and 2), the cDNA contained in Clone ID NO:Z, or the polynucleotide sequence as defined in column 6 of Table 1B, may be analyzed to

determine certain preferred regions of the polypeptide. For example, the amino acid sequence of a polypeptide encoded by a polynucleotide sequence of SEQ ID NO:X (e.g., the polypeptide of SEQ ID NO:Y and the polypeptide encoded by the portion of SEQ ID NO:X as defined in columns 8 and 9 of Table 2) or the cDNA contained in Clone ID NO:Z may be analyzed using the default parameters of the DNASTAR computer algorithm (DNASTAR, Inc., 1228 S. Park St., Madison, WI 53715 USA; <http://www.dnastar.com/>).

- [0170] Polypeptide regions that may be routinely obtained using the DNASTAR computer algorithm include, but are not limited to, Garnier-Robson alpha-regions, beta-regions, turn-regions, and coil-regions; Chou-Fasman alpha-regions, beta-regions, and turn-regions; Kyte-Doolittle hydrophilic regions and hydrophobic regions; Eisenberg alpha- and beta-amphipathic regions; Karplus-Schulz flexible regions; Emini surface-forming regions; and Jameson-Wolf regions of high antigenic index. Among highly preferred polynucleotides of the invention in this regard are those that encode polypeptides comprising regions that combine several structural features, such as several (e.g., 1, 2, 3 or 4) of the features set out above.
- [0171] Additionally, Kyte-Doolittle hydrophilic regions and hydrophobic regions, Emini surface-forming regions, and Jameson-Wolf regions of high antigenic index (i.e., containing four or more contiguous amino acids having an antigenic index of greater than or equal to 1.5, as identified using the default parameters of the Jameson-Wolf program) can routinely be used to determine polypeptide regions that exhibit a high degree of potential for antigenicity. Regions of high antigenicity are determined from data by DNASTAR analysis by choosing values which represent regions of the polypeptide which are likely to be exposed on the surface of the polypeptide in an environment in which antigen recognition may occur in the process of initiation of an immune response.
- [0172] Preferred polypeptide fragments of the invention are fragments comprising, or alternatively, consisting of, an amino acid sequence that displays a functional activity (e.g. biological activity) of the polypeptide sequence of which the amino acid sequence is a fragment. By a polypeptide displaying a "functional activity" is meant a polypeptide capable of one or more known functional activities associated with a full-

length protein, such as, for example, biological activity, antigenicity, immunogenicity, and/or multimerization, as described herein.

[0173] Other preferred polypeptide fragments are biologically active fragments. Biologically active fragments are those exhibiting activity similar, but not necessarily identical, to an activity of the polypeptide of the present invention. The biological activity of the fragments may include an improved desired activity, or a decreased undesirable activity.

[0174] In preferred embodiments, polypeptides of the invention comprise, or alternatively consist of, one, two, three, four, five or more of the antigenic fragments of the polypeptide of SEQ ID NO:Y, or portions thereof. Polynucleotides encoding these polypeptides are also encompassed by the invention.

[0175] The present invention encompasses polypeptides comprising, or alternatively consisting of, an epitope of: the polypeptide sequence shown in SEQ ID NO:Y; a polypeptide sequence encoded by SEQ ID NO:X or the complementary strand thereto; the polypeptide sequence encoded by the portion of SEQ ID NO:X as defined in columns 8 and 9 of Table 2; the polypeptide sequence encoded by the portion of SEQ ID NO:B as defined in column 6 of Table 1B or the complement thereto; the polypeptide sequence encoded by the cDNA contained in Clone ID NO:Z; or the polypeptide sequence encoded by a polynucleotide that hybridizes to the sequence of SEQ ID NO:X, the complement of the sequence of SEQ ID NO:X, the complement of a portion of SEQ ID NO:X as defined in columns 8 and 9 of Table 2, or the cDNA sequence contained in Clone ID NO:Z under stringent hybridization conditions or alternatively, under lower stringency hybridization as defined *supra*. The present invention further encompasses polynucleotide sequences encoding an epitope of a polypeptide sequence of the invention (such as, for example, the sequence disclosed in SEQ ID NO:X, or a fragment thereof), polynucleotide sequences of the complementary strand of a polynucleotide sequence encoding an epitope of the invention, and polynucleotide sequences which hybridize to the complementary strand under stringent hybridization conditions or alternatively, under lower stringency hybridization conditions defined *supra*.

[0176] The term "epitopes," as used herein, refers to portions of a polypeptide having antigenic or immunogenic activity in an animal, preferably a mammal, and

most preferably in a human. In a preferred embodiment, the present invention encompasses a polypeptide comprising an epitope, as well as the polynucleotide encoding this polypeptide. An "immunogenic epitope," as used herein, is defined as a portion of a protein that elicits an antibody response in an animal, as determined by any method known in the art, for example, by the methods for generating antibodies described *infra*. (See, for example, Geysen et al., Proc. Natl. Acad. Sci. USA 81:3998-4002 (1983)). The term "antigenic epitope," as used herein, is defined as a portion of a protein to which an antibody can immunospecifically bind its antigen as determined by any method well known in the art, for example, by the immunoassays described herein. Immunospecific binding excludes non-specific binding but does not necessarily exclude cross-reactivity with other antigens. Antigenic epitopes need not necessarily be immunogenic.

[0177] Fragments which function as epitopes may be produced by any conventional means. (See, e.g., Houghten, R. A., Proc. Natl. Acad. Sci. USA 82:5131-5135 (1985) further described in U.S. Patent No. 4,631,211.)

[0178] In the present invention, antigenic epitopes preferably contain a sequence of at least 4, at least 5, at least 6, at least 7, more preferably at least 8, at least 9, at least 10, at least 11, at least 12, at least 13, at least 14, at least 15, at least 20, at least 25, at least 30, at least 40, at least 50, and, most preferably, between about 15 to about 30 amino acids. Preferred polypeptides comprising immunogenic or antigenic epitopes are at least 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, or 100 amino acid residues in length. Additional non-exclusive preferred antigenic epitopes include the antigenic epitopes disclosed herein, as well as portions thereof. Antigenic epitopes are useful, for example, to raise antibodies, including monoclonal antibodies, that specifically bind the epitope. Preferred antigenic epitopes include the antigenic epitopes disclosed herein, as well as any combination of two, three, four, five or more of these antigenic epitopes. Antigenic epitopes can be used as the target molecules in immunoassays. (See, for instance, Wilson et al., Cell 37:767-778 (1984); Sutcliffe et al., Science 219:660-666 (1983)).

[0179] Non-limiting examples of epitopes of polypeptides that can be used to generate antibodies of the invention include a polypeptide comprising, or alternatively consisting of, at least one, two, three, four, five, six or more of the portion(s) of SEQ

ID NO:Y specified in column 6 of Table 1A. These polypeptide fragments have been determined to bear antigenic epitopes of the proteins of the invention by the analysis of the Jameson-Wolf antigenic index which is included in the DNASTar suite of computer programs. By "comprise" it is intended that a polypeptide contains at least one, two, three, four, five, six or more of the portion(s) of SEQ ID NO:Y shown in column 6 of Table 1A, but it may contain additional flanking residues on either the amino or carboxyl termini of the recited portion. Such additional flanking sequences are preferably sequences naturally found adjacent to the portion; i.e., contiguous sequence shown in SEQ ID NO:Y. The flanking sequence may, however, be sequences from a heterologous polypeptide, such as from another protein described herein or from a heterologous polypeptide not described herein. In particular embodiments, epitope portions of a polypeptide of the invention comprise one, two, three, or more of the portions of SEQ ID NO:Y shown in column 6 of Table 1A. Polynucleotides encoding these polypeptides are also encompassed by the invention.

[0180] Similarly, immunogenic epitopes can be used, for example, to induce antibodies according to methods well known in the art. See, for instance, Sutcliffe et al., *supra*; Wilson et al., *supra*; Chow et al., Proc. Natl. Acad. Sci. USA 82:910-914; and Bittle et al., J. Gen. Virol. 66:2347-2354 (1985). Preferred immunogenic epitopes include the immunogenic epitopes disclosed herein, as well as any combination of two, three, four, five or more of these immunogenic epitopes. The polypeptides comprising one or more immunogenic epitopes may be presented for eliciting an antibody response together with a carrier protein, such as an albumin, to an animal system (such as rabbit or mouse), or, if the polypeptide is of sufficient length (at least about 25 amino acids), the polypeptide may be presented without a carrier. However, immunogenic epitopes comprising as few as 8 to 10 amino acids have been shown to be sufficient to raise antibodies capable of binding to, at the very least, linear epitopes in a denatured polypeptide (e.g., in Western blotting).

[0181] Epitope-bearing polypeptides of the present invention may be used to induce antibodies according to methods well known in the art including, but not limited to, *in vivo* immunization, *in vitro* immunization, and phage display methods. See, e.g., Sutcliffe et al., *supra*; Wilson et al., *supra*, and Bittle et al., J. Gen. Virol., 66:2347-2354 (1985). If *in vivo* immunization is used, animals may be immunized

with free peptide; however, anti-peptide antibody titer may be boosted by coupling the peptide to a macromolecular carrier, such as keyhole limpet hemacyanin (KLH) or tetanus toxoid. For instance, peptides containing cysteine residues may be coupled to a carrier using a linker such as maleimidobenzoyl- N-hydroxysuccinimide ester (MBS), while other peptides may be coupled to carriers using a more general linking agent such as glutaraldehyde. Animals such as rabbits, rats and mice are immunized with either free or carrier- coupled peptides, for instance, by intraperitoneal and/or intradermal injection of emulsions containing about 100 µg of peptide or carrier protein and Freund's adjuvant or any other adjuvant known for stimulating an immune response. Several booster injections may be needed, for instance, at intervals of about two weeks, to provide a useful titer of anti-peptide antibody which can be detected, for example, by ELISA assay using free peptide adsorbed to a solid surface. The titer of anti-peptide antibodies in serum from an immunized animal may be increased by selection of anti-peptide antibodies, for instance, by adsorption to the peptide on a solid support and elution of the selected antibodies according to methods well known in the art.

[0182] As one of skill in the art will appreciate, and as discussed above, the polypeptides of the present invention (e.g., those comprising an immunogenic or antigenic epitope) can be fused to heterologous polypeptide sequences. For example, polypeptides of the present invention (including fragments or variants thereof), may be fused with the constant domain of immunoglobulins (IgA, IgE, IgG, IgM), or portions thereof (CH1, CH2, CH3, or any combination thereof and portions thereof, resulting in chimeric polypeptides. By way of another non-limiting example, polypeptides and/or antibodies of the present invention (including fragments or variants thereof) may be fused with albumin (including but not limited to recombinant human serum albumin or fragments or variants thereof (see, e.g., U.S. Patent No. 5,876,969, issued March 2, 1999, EP Patent 0 413 622, and U.S. Patent No. 5,766,883, issued June 16, 1998, herein incorporated by reference in their entirety)). In a preferred embodiment, polypeptides and/or antibodies of the present invention (including fragments or variants thereof) are fused with the mature form of human serum albumin (i.e., amino acids 1 – 585 of human serum albumin as shown in Figures 1 and 2 of EP Patent 0 322 094) which is herein incorporated by reference in its entirety. In another preferred

embodiment, polypeptides and/or antibodies of the present invention (including fragments or variants thereof) are fused with polypeptide fragments comprising, or alternatively consisting of, amino acid residues 1-z of human serum albumin, where z is an integer from 369 to 419, as described in U.S. Patent 5,766,883 herein incorporated by reference in its entirety. Polypeptides and/or antibodies of the present invention (including fragments or variants thereof) may be fused to either the N- or C-terminal end of the heterologous protein (e.g., immunoglobulin Fc polypeptide or human serum albumin polypeptide). Polynucleotides encoding fusion proteins of the invention are also encompassed by the invention.

[0183] Such fusion proteins as those described above may facilitate purification and may increase half-life *in vivo*. This has been shown for chimeric proteins consisting of the first two domains of the human CD4-polypeptide and various domains of the constant regions of the heavy or light chains of mammalian immunoglobulins. See, e.g., EP 394,827; Traunecker et al., *Nature*, 331:84-86 (1988). Enhanced delivery of an antigen across the epithelial barrier to the immune system has been demonstrated for antigens (e.g., insulin) conjugated to an FcRn binding partner such as IgG or Fc fragments (see, e.g., PCT Publications WO 96/22024 and WO 99/04813). IgG Fusion proteins that have a disulfide-linked dimeric structure due to the IgG portion disulfide bonds have also been found to be more efficient in binding and neutralizing other molecules than monomeric polypeptides or fragments thereof alone. See, e.g., Fountoulakis et al., *J. Biochem.*, 270:3958-3964 (1995). Nucleic acids encoding the above epitopes can also be recombined with a gene of interest as an epitope tag (e.g., the hemagglutinin (iHAi) tag or flag tag) to aid in detection and purification of the expressed polypeptide. For example, a system described by Janknecht et al. allows for the ready purification of non-denatured fusion proteins expressed in human cell lines (Janknecht et al., 1991, *Proc. Natl. Acad. Sci. USA* 88:8972- 897). In this system, the gene of interest is subcloned into a vaccinia recombination plasmid such that the open reading frame of the gene is translationally fused to an amino-terminal tag consisting of six histidine residues. The tag serves as a matrix binding domain for the fusion protein. Extracts from cells infected with the recombinant vaccinia virus are loaded onto Ni²⁺ nitriloacetic acid-agarose column

and histidine-tagged proteins can be selectively eluted with imidazole-containing buffers.

Fusion Proteins

[0184] Any polypeptide of the present invention can be used to generate fusion proteins. For example, the polypeptide of the present invention, when fused to a second protein, can be used as an antigenic tag. Antibodies raised against the polypeptide of the present invention can be used to indirectly detect the second protein by binding to the polypeptide. Moreover, because secreted proteins target cellular locations based on trafficking signals, polypeptides of the present invention which are shown to be secreted can be used as targeting molecules once fused to other proteins.

[0185] Examples of domains that can be fused to polypeptides of the present invention include not only heterologous signal sequences, but also other heterologous functional regions. The fusion does not necessarily need to be direct, but may occur through linker sequences.

[0186] In certain preferred embodiments, proteins of the invention are fusion proteins comprising an amino acid sequence that is an N and/or C- terminal deletion of a polypeptide of the invention. In preferred embodiments, the invention is directed to a fusion protein comprising an amino acid sequence that is at least 80%, 85%, 90%, 95%, 96%, 97%, 98% or 99% identical to a polypeptide sequence of the invention. Polynucleotides encoding these proteins are also encompassed by the invention.

[0187] Moreover, fusion proteins may also be engineered to improve characteristics of the polypeptide of the present invention. For instance, a region of additional amino acids, particularly charged amino acids, may be added to the N-terminus of the polypeptide to improve stability and persistence during purification from the host cell or subsequent handling and storage. Also, peptide moieties may be added to the polypeptide to facilitate purification. Such regions may be removed prior to final preparation of the polypeptide. The addition of peptide moieties to facilitate handling of polypeptides are familiar and routine techniques in the art.

[0188] As one of skill in the art will appreciate that, as discussed above, polypeptides of the present invention, and epitope-bearing fragments thereof, can be combined with heterologous polypeptide sequences. For example, the polypeptides of

the present invention may be fused with heterologous polypeptide sequences, for example, the polypeptides of the present invention may be fused with the constant domain of immunoglobulins (IgA, IgE, IgG, IgM) or portions thereof (CH1, CH2, CH3, and any combination thereof, including both entire domains and portions thereof), or albumin (including, but not limited to, native or recombinant human albumin or fragments or variants thereof (see, e.g., U.S. Patent No. 5,876,969, issued March 2, 1999, EP Patent 0 413 622, and U.S. Patent No. 5,766,883, issued June 16, 1998, herein incorporated by reference in their entirety)), resulting in chimeric polypeptides. For example, EP-A-O 464 533 (Canadian counterpart 2045869) discloses fusion proteins comprising various portions of constant region of immunoglobulin molecules together with another human protein or part thereof. In many cases, the Fc part in a fusion protein is beneficial in therapy and diagnosis, and thus can result in, for example, improved pharmacokinetic properties (EP-A 0232 262). Alternatively, deleting the Fc part after the fusion protein has been expressed, detected, and purified, would be desired. For example, the Fc portion may hinder therapy and diagnosis if the fusion protein is used as an antigen for immunizations. In drug discovery, for example, human proteins, such as hIL-5, have been fused with Fc portions for the purpose of high-throughput screening assays to identify antagonists of hIL-5. See, D. Bennett et al., *J. Molecular Recognition* 8:52-58 (1995); K. Johanson et al., *J. Biol. Chem.* 270:9459-9471 (1995).

[0189] Moreover, the polypeptides of the present invention can be fused to marker sequences, such as a polypeptide which facilitates purification of the fused polypeptide. In preferred embodiments, the marker amino acid sequence is a hexa-histidine peptide, such as the tag provided in a pQE vector (QIAGEN, Inc., 9259 Eton Avenue, Chatsworth, CA, 91311), among others, many of which are commercially available. As described in Gentz et al., *Proc. Natl. Acad. Sci. USA* 86:821-824 (1989), for instance, hexa-histidine provides for convenient purification of the fusion protein. Another peptide tag useful for purification, the "HA" tag, corresponds to an epitope derived from the influenza hemagglutinin protein (Wilson et al., *Cell* 37:767 (1984).)

[0190] Additional fusion proteins of the invention may be generated through the techniques of gene-shuffling, motif-shuffling, exon-shuffling, and/or codon-shuffling

(collectively referred to as "DNA shuffling"), briefly described below, and further described herein. DNA shuffling may be employed to modulate the activities of polypeptides of the invention, such methods can be used to generate polypeptides with altered activity, as well as agonists and antagonists of the polypeptides. See, generally, U.S. Patent Nos. 5,605,793; 5,811,238; 5,830,721; 5,834,252; and 5,837,458, and Patten et al., Curr. Opin. Biotechnol. 8:724-33 (1997); Harayama, Trends Biotechnol. 16(2):76-82 (1998); Hansson et al., J. Mol. Biol. 287:265-76 (1999); and Lorenzo and Blasco, Biotechniques 24(2):308-13 (1998); each of these patents and publications are hereby incorporated by reference in its entirety). In a preferred embodiment, one or more components, motifs, sections, parts, domains, fragments, etc., of a polynucleotide encoding a polypeptide of the invention may be recombined with one or more components, motifs, sections, parts, domains, fragments, etc., of one or more heterologous molecules encoding a heterologous polypeptide.

[0191] Thus, any of these above fusions can be engineered using the polynucleotides or the polypeptides of the present invention.

Recombinant and Synthetic Production of Polypeptides of the Invention

[0192] The present invention also relates to vectors containing the polynucleotide of the present invention, host cells, and the production of polypeptides by synthetic and recombinant techniques. The vector may be, for example, a phage, plasmid, viral, or retroviral vector. Retroviral vectors may be replication competent or replication defective. In the latter case, viral propagation generally will occur only in complementing host cells.

[0193] The polynucleotides of the invention may be joined to a vector containing a selectable marker for propagation in a host. Generally, a plasmid vector is introduced in a precipitate, such as a calcium phosphate precipitate, or in a complex with a charged lipid. If the vector is a virus, it may be packaged *in vitro* using an appropriate packaging cell line and then transduced into host cells.

[0194] The polynucleotide insert should be operatively linked to an appropriate promoter, such as the phage lambda PL promoter, the *E. coli lac*, *trp*, *phoA* and *tac* promoters, the SV40 early and late promoters and promoters of retroviral LTRs, to

name a few. Other suitable promoters will be known to the skilled artisan. The expression constructs will further contain sites for transcription initiation, termination, and, in the transcribed region, a ribosome binding site for translation. The coding portion of the transcripts expressed by the constructs will preferably include a translation initiating codon at the beginning and a termination codon (UAA, UGA or UAG) appropriately positioned at the end of the polypeptide to be translated.

[0195] As indicated, the expression vectors will preferably include at least one selectable marker. Such markers include dihydrofolate reductase, G418 or neomycin resistance, glutamine synthase, for eukaryotic cell culture and tetracycline, kanamycin or ampicillin resistance genes for culturing in *E. coli* and other bacteria. Representative examples of appropriate hosts include, but are not limited to, bacterial cells, such as *E. coli*, *Streptomyces* and *Salmonella typhimurium* cells; fungal cells, such as yeast cells (e.g., *Saccharomyces cerevisiae* or *Pichia pastoris* (ATCC Accession No. 201178)); insect cells such as *Drosophila* S2 and *Spodoptera* Sf9 cells; animal cells such as CHO, COS, 293, NSO and Bowes melanoma cells; and plant cells. Appropriate culture mediums and conditions for the above-described host cells are known in the art.

[0196] Among vectors preferred for use in bacteria include pQE70, pQE60 and pQE-9, available from QIAGEN, Inc.; pBluescript vectors, Phagescript vectors, pNH8A, pNH16a, pNH18A, pNH46A, available from Stratagene Cloning Systems, Inc.; and ptrc99a, pKK223-3, pKK233-3, pDR540, pRIT5 available from Pharmacia Biotech, Inc. Among preferred eukaryotic vectors are pWLNEO, pSV2CAT, pOG44, pXT1 and pSG available from Stratagene; and pSVK3, pBPV, pMSG and pSVL available from Pharmacia. Preferred expression vectors for use in yeast systems include, but are not limited to pYES2, pYD1, pTEF1/Zeo, pYES2/GS, pPICZ, pGAPZ, pGAPZalph, pPIC9, pPIC3.5, pHL-D2, pHL-S1, pPIC3.5K, pPIC9K, and PAO815 (all available from Invitrogen, Carlsbad, CA). Other suitable vectors will be readily apparent to the skilled artisan.

[0197] Vectors which use glutamine synthase (GS) or DHFR as the selectable markers can be amplified in the presence of the drugs methionine sulfoximine or methotrexate, respectively. An advantage of glutamine synthase based vectors is the availability of cell lines (e.g., the murine myeloma cell line, NS0) which are glutamine

synthase negative. Glutamine synthase expression systems can also function in glutamine synthase expressing cells (e.g., Chinese Hamster Ovary (CHO) cells) by providing additional inhibitor to prevent the functioning of the endogenous gene. A glutamine synthase expression system and components thereof are detailed in PCT publications: WO87/04462; WO86/05807; WO89/01036; WO89/10404; and WO91/06657 which are hereby incorporated in their entireties by reference herein. Additionally, glutamine synthase expression vectors can be obtained from Lonza Biologics, Inc. (Portsmouth, NH). Expression and production of monoclonal antibodies using a GS expression system in murine myeloma cells is described in Bebbington et al., *Bio/technology* 10:169(1992) and in Biblia and Robinson *Biotechnol. Prog.* 11:1 (1995) which are herein incorporated by reference.

[0198] The present invention also relates to host cells containing the above-described vector constructs described herein, and additionally encompasses host cells containing nucleotide sequences of the invention that are operably associated with one or more heterologous control regions (e.g., promoter and/or enhancer) using techniques known of in the art. The host cell can be a higher eukaryotic cell, such as a mammalian cell (e.g., a human derived cell), or a lower eukaryotic cell, such as a yeast cell, or the host cell can be a prokaryotic cell, such as a bacterial cell. A host strain may be chosen which modulates the expression of the inserted gene sequences, or modifies and processes the gene product in the specific fashion desired. Expression from certain promoters can be elevated in the presence of certain inducers; thus expression of the genetically engineered polypeptide may be controlled. Furthermore, different host cells have characteristics and specific mechanisms for the translational and post-translational processing and modification (e.g., phosphorylation, cleavage) of proteins. Appropriate cell lines can be chosen to ensure the desired modifications and processing of the foreign protein expressed.

[0199] Introduction of the nucleic acids and nucleic acid constructs of the invention into the host cell can be effected by calcium phosphate transfection, DEAE-dextran mediated transfection, cationic lipid-mediated transfection, electroporation, transduction, infection, or other methods. Such methods are described in many standard laboratory manuals, such as Davis et al., *Basic Methods In Molecular*

Biology (1986). It is specifically contemplated that the polypeptides of the present invention may in fact be expressed by a host cell lacking a recombinant vector.

[0200] In addition to encompassing host cells containing the vector constructs discussed herein, the invention also encompasses primary, secondary, and immortalized host cells of vertebrate origin, particularly mammalian origin, that have been engineered to delete or replace endogenous genetic material (e.g., reproductive system antigen coding sequence), and/or to include genetic material (e.g., heterologous polynucleotide sequences) that is operably associated with reproductive system associated polynucleotides of the invention, and which activates, alters, and/or amplifies endogenous reproductive system associated polynucleotides. For example, techniques known in the art may be used to operably associate heterologous control regions (e.g., promoter and/or enhancer) and endogenous reproductive system associated polynucleotide sequences via homologous recombination (see, e.g., U.S. Patent Number 5,641,670, issued June 24, 1997; International Publication Number WO 96/29411; International Publication Number WO 94/12650; Koller et al., Proc. Natl. Acad. Sci. USA 86:8932-8935 (1989); and Zijlstra et al., Nature 342:435-438 (1989), the disclosures of each of which are incorporated by reference in their entireties).

[0201] Polypeptides of the present invention can also be recovered from: products purified from natural sources, including bodily fluids, tissues and cells, whether directly isolated or cultured; products of chemical synthetic procedures; and products produced by recombinant techniques from a prokaryotic or eukaryotic host, including, for example, bacterial, yeast, higher plant, insect, and mammalian cells. Depending upon the host employed in a recombinant production procedure, the polypeptides of the present invention may be glycosylated or may be non-glycosylated. In addition, polypeptides of the invention may also include an initial modified methionine residue, in some cases as a result of host-mediated processes. Thus, it is well known in the art that the N-terminal methionine encoded by the translation initiation codon generally is removed with high efficiency from any protein after translation in all eukaryotic cells. While the N-terminal methionine on most proteins also is efficiently removed in most prokaryotes, for some proteins, this prokaryotic removal process is inefficient,

depending on the nature of the amino acid to which the N-terminal methionine is covalently linked.

[0202] In one embodiment, the yeast *Pichia pastoris* is used to express polypeptides of the invention in a eukaryotic system. *Pichia pastoris* is a methylotrophic yeast which can metabolize methanol as its sole carbon source. A main step in the methanol metabolism pathway is the oxidation of methanol to formaldehyde using O₂. This reaction is catalyzed by the enzyme alcohol oxidase. In order to metabolize methanol as its sole carbon source, *Pichia pastoris* must generate high levels of alcohol oxidase due, in part, to the relatively low affinity of alcohol oxidase for O₂. Consequently, in a growth medium depending on methanol as a main carbon source, the promoter region of one of the two alcohol oxidase genes (*AOX1*) is highly active. In the presence of methanol, alcohol oxidase produced from the *AOX1* gene comprises up to approximately 30% of the total soluble protein in *Pichia pastoris*. See, Ellis, S.B., *et al.*, *Mol. Cell. Biol.* 5:1111-21 (1985); Koutz, P.J., *et al.*, *Yeast* 5:167-77 (1989); Tschopp, J.F., *et al.*, *Nucl. Acids Res.* 15:3859-76 (1987). Thus, a heterologous coding sequence, such as, for example, a polynucleotide of the present invention, under the transcriptional regulation of all or part of the *AOX1* regulatory sequence is expressed at exceptionally high levels in *Pichia* yeast grown in the presence of methanol.

[0203] In one example, the plasmid vector pPIC9K is used to express DNA encoding a polypeptide of the invention, as set forth herein, in a *Pichea* yeast system essentially as described in "*Pichia* Protocols: Methods in Molecular Biology," D.R. Higgins and J. Cregg, eds. The Humana Press, Totowa, NJ, 1998. This expression vector allows expression and secretion of a polypeptide of the invention by virtue of the strong *AOX1* promoter linked to the *Pichia pastoris* alkaline phosphatase (PHO) secretory signal peptide (i.e., leader) located upstream of a multiple cloning site.

[0204] Many other yeast vectors could be used in place of pPIC9K, such as, pYES2, pYD1, pTEF1/Zeo, pYES2/GS, pPICZ, pGAPZ, pGAPZalpha, pPIC9, pPIC3.5, pHIL-D2, pHIL-S1, pPIC3.5K, and PAO815, as one skilled in the art would readily appreciate, as long as the proposed expression construct provides appropriately

located signals for transcription, translation, secretion (if desired), and the like, including an in-frame AUG as required.

[0205] In another embodiment, high-level expression of a heterologous coding sequence, such as, for example, a polynucleotide of the present invention, may be achieved by cloning the heterologous polynucleotide of the invention into an expression vector such as, for example, pGAPZ or pGAPZalpha, and growing the yeast culture in the absence of methanol.

[0206] In addition to encompassing host cells containing the vector constructs discussed herein, the invention also encompasses primary, secondary, and immortalized host cells of vertebrate origin, particularly mammalian origin, that have been engineered to delete or replace endogenous genetic material (e.g., coding sequence), and/or to include genetic material (e.g., heterologous polynucleotide sequences) that is operably associated with polynucleotides of the invention, and which activates, alters, and/or amplifies endogenous polynucleotides. For example, techniques known in the art may be used to operably associate heterologous control regions (e.g., promoter and/or enhancer) and endogenous polynucleotide sequences via homologous recombination (see, e.g., U.S. Patent No. 5,641,670, issued June 24, 1997; International Publication No. WO 96/29411, published September 26, 1996; International Publication No. WO 94/12650, published August 4, 1994; Koller et al., Proc. Natl. Acad. Sci. USA 86:8932-8935 (1989); and Zijlstra et al., Nature 342:435-438 (1989), the disclosures of each of which are incorporated by reference in their entireties).

[0207] In addition, polypeptides of the invention can be chemically synthesized using techniques known in the art (e.g., see Creighton, 1983, Proteins: Structures and Molecular Principles, W.H. Freeman & Co., N.Y., and Hunkapiller et al., Nature, 310:105-111 (1984)). For example, a polypeptide corresponding to a fragment of a polypeptide can be synthesized by use of a peptide synthesizer. Furthermore, if desired, nonclassical amino acids or chemical amino acid analogs can be introduced as a substitution or addition into the polypeptide sequence. Non-classical amino acids include, but are not limited to, to the D-isomers of the common amino acids, 2,4-diaminobutyric acid, α -amino isobutyric acid, 4-aminobutyric acid, Abu, 2-amino butyric acid, γ -Abu, ϵ -Ahx, 6-amino hexanoic acid, Aib, 2-amino isobutyric acid,

3-amino propionic acid, ornithine, norleucine, norvaline, hydroxyproline, sarcosine, citrulline, homocitrulline, cysteic acid, t-butylglycine, t-butylalanine, phenylglycine, cyclohexylalanine, b-alanine, fluoro-amino acids, designer amino acids such as b-methyl amino acids, Ca-methyl amino acids, Na-methyl amino acids, and amino acid analogs in general. Furthermore, the amino acid can be D (dextrorotary) or L (levorotary).

[0208] The invention encompasses polypeptides of the present invention which are differentially modified during or after translation, e.g., by glycosylation, acetylation, phosphorylation, amidation, derivatization by known protecting/blocking groups, proteolytic cleavage, linkage to an antibody molecule or other cellular ligand, etc. Any of numerous chemical modifications may be carried out by known techniques, including but not limited, to specific chemical cleavage by cyanogen bromide, trypsin, chymotrypsin, papain, V8 protease, NaBH₄; acetylation, formylation, oxidation, reduction; metabolic synthesis in the presence of tunicamycin; etc.

[0209] Additional post-translational modifications encompassed by the invention include, for example, e.g., N-linked or O-linked carbohydrate chains, processing of N-terminal or C-terminal ends), attachment of chemical moieties to the amino acid backbone, chemical modifications of N-linked or O-linked carbohydrate chains, and addition or deletion of an N-terminal methionine residue as a result of procaryotic host cell expression. The polypeptides may also be modified with a detectable label, such as an enzymatic, fluorescent, isotopic or affinity label to allow for detection and isolation of the protein.

[0210] Examples of suitable enzymes include horseradish peroxidase, alkaline phosphatase, beta-galactosidase, or acetylcholinesterase; examples of suitable prosthetic group complexes include streptavidin/biotin and avidin/biotin; examples of suitable fluorescent materials include umbelliferone, fluorescein, fluorescein isothiocyanate, rhodamine, dichlorotriazinylamine fluorescein, dansyl chloride or phycoerythrin; an example of a luminescent material includes luminol; examples of bioluminescent materials include luciferase, luciferin, and aequorin; and examples of suitable radioactive material include iodine (¹²¹I, ¹²³I, ¹²⁵I, ¹³¹I), carbon (¹⁴C), sulfur (³⁵S), tritium (³H), indium (¹¹¹In, ¹¹²In, ^{113m}In, ^{115m}In), technetium (⁹⁹Tc, ^{99m}Tc), thallium (²⁰¹Tl), gallium (⁶⁸Ga, ⁶⁷Ga), palladium (¹⁰³Pd), molybdenum (⁹⁹Mo), xenon

(¹³³Xe), fluorine (¹⁸F), ¹⁵³Sm, ¹⁷⁷Lu, ¹⁵⁹Gd, ¹⁴⁹Pm, ¹⁴⁰La, ¹⁷⁵Yb, ¹⁶⁶Ho, ⁹⁰Y, ⁴⁷Sc, ¹⁸⁶Re, ¹⁸⁸Re, ¹⁴²Pr, ¹⁰⁵Rh, and ⁹⁷Ru.

[0211] In specific embodiments, a polypeptide of the present invention or fragment or variant thereof is attached to macrocyclic chelators that associate with radiometal ions, including but not limited to, ¹⁷⁷Lu, ⁹⁰Y, ¹⁶⁶Ho, and ¹⁵³Sm, to polypeptides. In a preferred embodiment, the radiometal ion associated with the macrocyclic chelators is ¹¹¹In. In another preferred embodiment, the radiometal ion associated with the macrocyclic chelator is ⁹⁰Y. In specific embodiments, the macrocyclic chelator is 1,4,7,10-tetraazacyclododecane-N,N',N'',N'''-tetraacetic acid (DOTA). In other specific embodiments, DOTA is attached to an antibody of the invention or fragment thereof via a linker molecule. Examples of linker molecules useful for conjugating DOTA to a polypeptide are commonly known in the art - see, for example, DeNardo et al., Clin Cancer Res. 4(10):2483-90 (1998); Peterson et al., Bioconjug. Chem. 10(4):553-7 (1999); and Zimmerman et al, Nucl. Med. Biol. 26(8):943-50 (1999); which are hereby incorporated by reference in their entirety.

[0212] As mentioned, the reproductive system associated proteins of the invention may be modified by either natural processes, such as posttranslational processing, or by chemical modification techniques which are well known in the art. It will be appreciated that the same type of modification may be present in the same or varying degrees at several sites in a given reproductive system associated polypeptide. Reproductive system associated polypeptides may be branched, for example, as a result of ubiquitination, and they may be cyclic, with or without branching. Cyclic, branched, and branched cyclic reproductive system associated polypeptides may result from posttranslation natural processes or may be made by synthetic methods. Modifications include acetylation, acylation, ADP-ribosylation, amidation, covalent attachment of flavin, covalent attachment of a heme moiety, covalent attachment of a nucleotide or nucleotide derivative, covalent attachment of a lipid or lipid derivative, covalent attachment of phosphatidylinositol, cross-linking, cyclization, disulfide bond formation, demethylation, formation of covalent cross-links, formation of cysteine, formation of pyroglutamate, formylation, gamma-carboxylation, glycosylation, GPI anchor formation, hydroxylation, iodination, methylation, myristoylation, oxidation, pegylation, proteolytic processing, phosphorylation, prenylation, racemization,

selenoylation, sulfation, transfer-RNA mediated addition of amino acids to proteins such as arginylation, and ubiquitination. (See, for instance, PROTEINS - STRUCTURE AND MOLECULAR PROPERTIES, 2nd Ed., T. E. Creighton, W. H. Freeman and Company, New York (1993); POSTTRANSLATIONAL COVALENT MODIFICATION OF PROTEINS, B. C. Johnson, Ed., Academic Press, New York, pgs. 1-12 (1983); Seifter et al., Meth. Enzymol. 182:626-646 (1990); Rattan et al., Ann. N.Y. Acad. Sci. 663:48-62 (1992)).

[0213] Also provided by the invention are chemically modified derivatives of the polypeptides of the invention which may provide additional advantages such as increased solubility, stability and circulating time of the polypeptide, or decreased immunogenicity (see U.S. Patent No. 4,179,337). The chemical moieties for derivitization may be selected from water soluble polymers such as polyethylene glycol, ethylene glycol/propylene glycol copolymers, carboxymethylcellulose, dextran, polyvinyl alcohol and the like. The polypeptides may be modified at random positions within the molecule, or at predetermined positions within the molecule and may include one, two, three or more attached chemical moieties.

[0214] The polymer may be of any molecular weight, and may be branched or unbranched. For polyethylene glycol, the preferred molecular weight is between about 1 kDa and about 100 kDa (the term "about" indicating that in preparations of polyethylene glycol, some molecules will weigh more, some less, than the stated molecular weight) for ease in handling and manufacturing. Other sizes may be used, depending on the desired therapeutic profile (e.g., the duration of sustained release desired, the effects, if any on biological activity, the ease in handling, the degree or lack of antigenicity and other known effects of the polyethylene glycol to a therapeutic protein or analog). For example, the polyethylene glycol may have an average molecular weight of about 200, 500, 1000, 1500, 2000, 2500, 3000, 3500, 4000, 4500, 5000, 5500, 6000, 6500, 7000, 7500, 8000, 8500, 9000, 9500, 10,000, 10,500, 11,000, 11,500, 12,000, 12,500, 13,000, 13,500, 14,000, 14,500, 15,000, 15,500, 16,000, 16,500, 17,000, 17,500, 18,000, 18,500, 19,000, 19,500, 20,000, 25,000, 30,000, 35,000, 40,000, 50,000, 55,000, 60,000, 65,000, 70,000, 75,000, 80,000, 85,000, 90,000, 95,000, or 100,000 kDa.

[0215] As noted above, the polyethylene glycol may have a branched structure.

Branched polyethylene glycols are described, for example, in U.S. Patent No. 5,643,575; Morpurgo et al., *Appl. Biochem. Biotechnol.* 56:59-72 (1996); Vorobjev et al., *Nucleosides Nucleotides* 18:2745-2750 (1999); and Caliceti et al., *Bioconjug. Chem.* 10:638-646 (1999), the disclosures of each of which are incorporated herein by reference.

[0216] The polyethylene glycol molecules (or other chemical moieties) should be attached to the protein with consideration of effects on functional or antigenic domains of the protein. There are a number of attachment methods available to those skilled in the art, such as, for example, the method disclosed in EP 0 401 384 (coupling PEG to G-CSF), herein incorporated by reference; see also Malik et al., *Exp. Hematol.* 20:1028-1035 (1992), reporting pegylation of GM-CSF using tresyl chloride. For example, polyethylene glycol may be covalently bound through amino acid residues via a reactive group, such as a free amino or carboxyl group. Reactive groups are those to which an activated polyethylene glycol molecule may be bound. The amino acid residues having a free amino group may include lysine residues and the N-terminal amino acid residues; those having a free carboxyl group may include aspartic acid residues glutamic acid residues and the C-terminal amino acid residue. Sulfhydryl groups may also be used as a reactive group for attaching the polyethylene glycol molecules. Preferred for therapeutic purposes is attachment at an amino group, such as attachment at the N-terminus or lysine group.

[0217] As suggested above, polyethylene glycol may be attached to proteins via linkage to any of a number of amino acid residues. For example, polyethylene glycol can be linked to proteins via covalent bonds to lysine, histidine, aspartic acid, glutamic acid, or cysteine residues. One or more reaction chemistries may be employed to attach polyethylene glycol to specific amino acid residues (e.g., lysine, histidine, aspartic acid, glutamic acid, or cysteine) of the protein or to more than one type of amino acid residue (e.g., lysine, histidine, aspartic acid, glutamic acid, cysteine and combinations thereof) of the protein.

[0218] One may specifically desire proteins chemically modified at the N-terminus. Using polyethylene glycol as an illustration of the present composition, one may select from a variety of polyethylene glycol molecules (by molecular weight, branching, etc.), the proportion of polyethylene glycol molecules to protein

(polypeptide) molecules in the reaction mix, the type of pegylation reaction to be performed, and the method of obtaining the selected N-terminally pegylated protein. The method of obtaining the N-terminally pegylated preparation (i.e., separating this moiety from other monopegylated moieties if necessary) may be by purification of the N-terminally pegylated material from a population of pegylated protein molecules. Selective proteins chemically modified at the N-terminus modification may be accomplished by reductive alkylation which exploits differential reactivity of different types of primary amino groups (lysine versus the N-terminal) available for derivatization in a particular protein. Under the appropriate reaction conditions, substantially selective derivatization of the protein at the N-terminus with a carbonyl group containing polymer is achieved.

[0219] As indicated above, pegylation of the proteins of the invention may be accomplished by any number of means. For example, polyethylene glycol may be attached to the protein either directly or by an intervening linker. Linkerless systems for attaching polyethylene glycol to proteins are described in Delgado et al., Crit. Rev. Thera. Drug Carrier Sys. 9:249-304 (1992); Francis et al., Intern. J. of Hematol. 68:1-18 (1998); U.S. Patent No. 4,002,531; U.S. Patent No. 5,349,052; WO 95/06058; and WO 98/32466, the disclosures of each of which are incorporated herein by reference.

[0220] One system for attaching polyethylene glycol directly to amino acid residues of proteins without an intervening linker employs tresylated MPEG, which is produced by the modification of monmethoxy polyethylene glycol (MPEG) using tresylchloride ($\text{ClSO}_2\text{CH}_2\text{CF}_3$). Upon reaction of protein with tresylated MPEG, polyethylene glycol is directly attached to amine groups of the protein. Thus, the invention includes protein-polyethylene glycol conjugates produced by reacting proteins of the invention with a polyethylene glycol molecule having a 2,2,2-trifluoroethane sulphonyl group.

[0221] Polyethylene glycol can also be attached to proteins using a number of different intervening linkers. For example, U.S. Patent No. 5,612,460, the entire disclosure of which is incorporated herein by reference, discloses urethane linkers for connecting polyethylene glycol to proteins. Protein-polyethylene glycol conjugates wherein the polyethylene glycol is attached to the protein by a linker can also be produced by reaction of proteins with compounds such as MPEG-

succinimidylsuccinate, MPEG activated with 1,1'-carbonyldiimidazole, MPEG-2,4,5-trichloropenylcarbonate, MPEG-p-nitrophenolcarbonate, and various MPEG-succinate derivatives. A number of additional polyethylene glycol derivatives and reaction chemistries for attaching polyethylene glycol to proteins are described in International Publication No. WO 98/32466, the entire disclosure of which is incorporated herein by reference. Pegylated protein products produced using the reaction chemistries set out herein are included within the scope of the invention.

[0222] The number of polyethylene glycol moieties attached to each protein of the invention (i.e., the degree of substitution) may also vary. For example, the pegylated proteins of the invention may be linked, on average, to 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 15, 17, 20, or more polyethylene glycol molecules. Similarly, the average degree of substitution within ranges such as 1-3, 2-4, 3-5, 4-6, 5-7, 6-8, 7-9, 8-10, 9-11, 10-12, 11-13, 12-14, 13-15, 14-16, 15-17, 16-18, 17-19, or 18-20 polyethylene glycol moieties per protein molecule. Methods for determining the degree of substitution are discussed, for example, in Delgado et al., Crit. Rev. Thera. Drug Carrier Sys. 9:249-304 (1992).

[0223] The reproductive system associated polypeptides of the invention can be recovered and purified from chemical synthesis and recombinant cell cultures by standard methods which include, but are not limited to, ammonium sulfate or ethanol precipitation, acid extraction, anion or cation exchange chromatography, phosphocellulose chromatography, hydrophobic interaction chromatography, affinity chromatography, hydroxylapatite chromatography and lectin chromatography. Most preferably, high performance liquid chromatography ("HPLC") is employed for purification. Well known techniques for refolding protein may be employed to regenerate active conformation when the polypeptide is denatured during isolation and/or purification.

[0224] Reproductive system associated polynucleotides and polypeptides may be used in accordance with the present invention for a variety of applications, particularly those that make use of the chemical and biological properties of reproductive system associated antigens. Among these are applications in the detection, prevention, diagnosis and/or treatment of diseases associated with the reproductive system, such as e.g., cancers of the reproductive system, tumors, injuries and trauma, infections,

congenital defects, and diseases or disorders which result in infertility, complications with pregnancy, labor, or parturition, postpartum difficulties, and as listed below in the section entitled "Reproductive System Disorders". Additional applications relate to diagnosis and to treatment of disorders of cells, tissues and organisms. These aspects of the invention are discussed further below.

[0225] In a preferred embodiment, polynucleotides expressed in a particular tissue type (see, e.g., Table 1A, column 7) are used to detect, diagnose, treat, prevent and/or prognose disorders associated with the tissue type.

[0226] The polypeptides of the invention may be in monomers or multimers (i.e., dimers, trimers, tetramers and higher multimers). Accordingly, the present invention relates to monomers and multimers of the polypeptides of the invention, their preparation, and compositions (preferably, Therapeutics) containing them. In specific embodiments, the polypeptides of the invention are monomers, dimers, trimers or tetramers. In additional embodiments, the multimers of the invention are at least dimers, at least trimers, or at least tetramers.

[0227] Multimers encompassed by the invention may be homomers or heteromers. As used herein, the term homomer refers to a multimer containing only polypeptides corresponding to a protein of the invention (e.g., the amino acid sequence of SEQ ID NO:Y, an amino acid sequence encoded by SEQ ID NO:X or the complement of SEQ ID NO:X, the amino acid sequence encoded by the portion of SEQ ID NO:X as defined in columns 8 and 9 of Table 2, and/or an amino acid sequence encoded by cDNA contained in Clone ID NO:Z (including fragments, variants, splice variants, and fusion proteins, corresponding to these as described herein)). These homomers may contain polypeptides having identical or different amino acid sequences. In a specific embodiment, a homomer of the invention is a multimer containing only polypeptides having an identical amino acid sequence. In another specific embodiment, a homomer of the invention is a multimer containing polypeptides having different amino acid sequences. In specific embodiments, the multimer of the invention is a homodimer (e.g., containing two polypeptides having identical or different amino acid sequences) or a homotrimer (e.g., containing three polypeptides having identical and/or different amino acid sequences). In additional embodiments, the homomeric multimer of the invention is at least a homodimer, at least a homotrimer, or at least a homotetramer.

[0228] As used herein, the term heteromer refers to a multimer containing two or more heterologous polypeptides (i.e., polypeptides of different proteins) in addition to the polypeptides of the invention. In a specific embodiment, the multimer of the invention is a heterodimer, a heterotrimer, or a heterotetramer. In additional embodiments, the heteromeric multimer of the invention is at least a heterodimer, at least a heterotrimer, or at least a heterotetramer.

[0229] Multimers of the invention may be the result of hydrophobic, hydrophilic, ionic and/or covalent associations and/or may be indirectly linked by, for example, liposome formation. Thus, in one embodiment, multimers of the invention, such as, for example, homodimers or homotrimers, are formed when polypeptides of the invention contact one another in solution. In another embodiment, heteromultimers of the invention, such as, for example, heterotrimers or heterotetramers, are formed when polypeptides of the invention contact antibodies to the polypeptides of the invention (including antibodies to the heterologous polypeptide sequence in a fusion protein of the invention) in solution. In other embodiments, multimers of the invention are formed by covalent associations with and/or between the polypeptides of the invention. Such covalent associations may involve one or more amino acid residues contained in the polypeptide sequence (e.g., that recited in SEQ ID NO:Y, encoded by the portion of SEQ ID NO:X as defined in columns 8 and 9 of Table 2, and/or encoded by the cDNA contained in Clone ID NO:Z). In one instance, the covalent associations are cross-linking between cysteine residues located within the polypeptide sequences which interact in the native (i.e., naturally occurring) polypeptide. In another instance, the covalent associations are the consequence of chemical or recombinant manipulation. Alternatively, such covalent associations may involve one or more amino acid residues contained in the heterologous polypeptide sequence in a fusion protein. In one example, covalent associations are between the heterologous sequence contained in a fusion protein of the invention (see, e.g., U.S. Patent Number 5,478,925). In a specific example, the covalent associations are between the heterologous sequence contained in a Fc fusion protein of the invention (as described herein). In another specific example, covalent associations of fusion proteins of the invention are between heterologous polypeptide sequence from another protein that is capable of forming covalently associated multimers, such as for example,

osteoprotegerin (see, e.g., International Publication NO: WO 98/49305, the contents of which are herein incorporated by reference in its entirety). In another embodiment, two or more polypeptides of the invention are joined through peptide linkers. Examples include those peptide linkers described in U.S. Pat. No. 5,073,627 (hereby incorporated by reference). Proteins comprising multiple polypeptides of the invention separated by peptide linkers may be produced using conventional recombinant DNA technology.

[0230] Another method for preparing multimer polypeptides of the invention involves use of polypeptides of the invention fused to a leucine zipper or isoleucine zipper polypeptide sequence. Leucine zipper and isoleucine zipper domains are polypeptides that promote multimerization of the proteins in which they are found. Leucine zippers were originally identified in several DNA-binding proteins (Landschulz et al., Science 240:1759, (1988)), and have since been found in a variety of different proteins. Among the known leucine zippers are naturally occurring peptides and derivatives thereof that dimerize or trimerize. Examples of leucine zipper domains suitable for producing soluble multimeric proteins of the invention are those described in PCT application WO 94/10308, hereby incorporated by reference. Recombinant fusion proteins comprising a polypeptide of the invention fused to a polypeptide sequence that dimerizes or trimerizes in solution are expressed in suitable host cells, and the resulting soluble multimeric fusion protein is recovered from the culture supernatant using techniques known in the art.

[0231] Trimeric polypeptides of the invention may offer the advantage of enhanced biological activity. Preferred leucine zipper moieties and isoleucine moieties are those that preferentially form trimers. One example is a leucine zipper derived from lung surfactant protein D (SPD), as described in Hoppe et al. (FEBS Letters 344:191, (1994)) and in U.S. patent application Ser. No. 08/446,922, hereby incorporated by reference. Other peptides derived from naturally occurring trimeric proteins may be employed in preparing trimeric polypeptides of the invention.

[0232] In another example, proteins of the invention are associated by interactions between Flag® polypeptide sequence contained in fusion proteins of the invention containing Flag® polypeptide sequence. In a further embodiment, proteins of the

invention are associated by interactions between heterologous polypeptide sequence contained in Flag® fusion proteins of the invention and anti-Flag® antibody.

[0233] The multimers of the invention may be generated using chemical techniques known in the art. For example, polypeptides desired to be contained in the multimers of the invention may be chemically cross-linked using linker molecules and linker molecule length optimization techniques known in the art (see, e.g., U.S. Patent Number 5,478,925, which is herein incorporated by reference in its entirety). Additionally, multimers of the invention may be generated using techniques known in the art to form one or more inter-molecule cross-links between the cysteine residues located within the sequence of the polypeptides desired to be contained in the multimer (see, e.g., U.S. Patent Number 5,478,925, which is herein incorporated by reference in its entirety). Further, polypeptides of the invention may be routinely modified by the addition of cysteine or biotin to the C-terminus or N-terminus of the polypeptide and techniques known in the art may be applied to generate multimers containing one or more of these modified polypeptides (see, e.g., U.S. Patent Number 5,478,925, which is herein incorporated by reference in its entirety). Additionally, techniques known in the art may be applied to generate liposomes containing the polypeptide components desired to be contained in the multimer of the invention (see, e.g., U.S. Patent Number 5,478,925, which is herein incorporated by reference in its entirety).

[0234] Alternatively, multimers of the invention may be generated using genetic engineering techniques known in the art. In one embodiment, polypeptides contained in multimers of the invention are produced recombinantly using fusion protein technology described herein or otherwise known in the art (see, e.g., U.S. Patent Number 5,478,925, which is herein incorporated by reference in its entirety). In a specific embodiment, polynucleotides coding for a homodimer of the invention are generated by ligating a polynucleotide sequence encoding a polypeptide of the invention to a sequence encoding a linker polypeptide and then further to a synthetic polynucleotide encoding the translated product of the polypeptide in the reverse orientation from the original C-terminus to the N-terminus (lacking the leader sequence) (see, e.g., U.S. Patent Number 5,478,925, which is herein incorporated by reference in its entirety). In another embodiment, recombinant techniques described

herein or otherwise known in the art are applied to generate recombinant polypeptides of the invention which contain a transmembrane domain (or hydrophobic or signal peptide) and which can be incorporated by membrane reconstitution techniques into liposomes (see, e.g., U.S. Patent Number 5,478,925, which is herein incorporated by reference in its entirety).

Antibodies

[0235] Further polypeptides of the invention relate to antibodies and T-cell antigen receptors (TCR) which immunospecifically bind a polypeptide, polypeptide fragment, or variant of the invention (e.g., a polypeptide or fragment or variant of the amino acid sequence of SEQ ID NO:Y or a polypeptide encoded by the cDNA contained in Clone ID NO:Z, and/or an epitope, of the present invention) as determined by immunoassays well known in the art for assaying specific antibody-antigen binding. Antibodies of the invention include, but are not limited to, polyclonal, monoclonal, multispecific, human, humanized or chimeric antibodies, single chain antibodies, Fab fragments, F(ab') fragments, fragments produced by a Fab expression library, anti-idiotypic (anti-Id) antibodies (including, e.g., anti-Id antibodies to antibodies of the invention), intracellularly-made antibodies (i.e., intrabodies), and epitope-binding fragments of any of the above. The term "antibody," as used herein, refers to immunoglobulin molecules and immunologically active portions of immunoglobulin molecules, i.e., molecules that contain an antigen binding site that immunospecifically binds an antigen. The immunoglobulin molecules of the invention can be of any type (e.g., IgG, IgE, IgM, IgD, IgA and IgY), class (e.g., IgG1, IgG2, IgG3, IgG4, IgA1 and IgA2) or subclass of immunoglobulin molecule. In preferred embodiments, the immunoglobulin molecules of the invention are IgG1. In other preferred embodiments, the immunoglobulin molecules of the invention are IgG4.

[0236] Most preferably the antibodies are human antigen-binding antibody fragments of the present invention and include, but are not limited to, Fab, Fab' and F(ab')₂, Fd, single-chain Fvs (scFv), single-chain antibodies, disulfide-linked Fvs (sdFv) and fragments comprising either a VL or VH domain. Antigen-binding antibody fragments, including single-chain antibodies, may comprise the variable region(s) alone or in combination with the entirety or a portion of the following: hinge

region, CH1, CH2, and CH3 domains. Also included in the invention are antigen-binding fragments also comprising any combination of variable region(s) with a hinge region, CH1, CH2, and CH3 domains. The antibodies of the invention may be from any animal origin including birds and mammals. Preferably, the antibodies are human, murine (e.g., mouse and rat), donkey, sheep rabbit, goat, guinea pig, camel, horse, or chicken. As used herein, "human" antibodies include antibodies having the amino acid sequence of a human immunoglobulin and include antibodies isolated from human immunoglobulin libraries or from animals transgenic for one or more human immunoglobulin and that do not express endogenous immunoglobulins, as described *infra* and, for example in, U.S. Patent No. 5,939,598 by Kucherlapati et al.

[0237] The antibodies of the present invention may be monospecific, bispecific, trispecific or of greater multispecificity. Multispecific antibodies may be specific for different epitopes of a polypeptide of the present invention or may be specific for both a polypeptide of the present invention as well as for a heterologous epitope, such as a heterologous polypeptide or solid support material. See, e.g., PCT publications WO 93/17715; WO 92/08802; WO 91/00360; WO 92/05793; Tutt, et al., J. Immunol. 147:60-69 (1991); U.S. Patent Nos. 4,474,893; 4,714,681; 4,925,648; 5,573,920; 5,601,819; Kostelny et al., J. Immunol. 148:1547-1553 (1992).

[0238] Antibodies of the present invention may be described or specified in terms of the epitope(s) or portion(s) of a polypeptide of the present invention which they recognize or specifically bind. The epitope(s) or polypeptide portion(s) may be specified as described herein, e.g., by N-terminal and C-terminal positions, or by size in contiguous amino acid residues, or listed in the Tables and Figures. Preferred epitopes of the invention include those shown in column 6 of Table 1A, as well as polynucleotides that encode these epitopes. Antibodies which specifically bind any epitope or polypeptide of the present invention may also be excluded. Therefore, the present invention includes antibodies that specifically bind polypeptides of the present invention, and allows for the exclusion of the same.

[0239] Antibodies of the present invention may also be described or specified in terms of their cross-reactivity. Antibodies that do not bind any other analog, ortholog, or homolog of a polypeptide of the present invention are included. Antibodies that bind polypeptides with at least 95%, at least 90%, at least 85%, at least 80%, at least

75%, at least 70%, at least 65%, at least 60%, at least 55%, and at least 50% identity (as calculated using methods known in the art and described herein) to a polypeptide of the present invention are also included in the present invention. In specific embodiments, antibodies of the present invention cross-react with murine, rat and/or rabbit homologs of human proteins and the corresponding epitopes thereof. Antibodies that do not bind polypeptides with less than 95%, less than 90%, less than 85%, less than 80%, less than 75%, less than 70%, less than 65%, less than 60%, less than 55%, and less than 50% identity (as calculated using methods known in the art and described herein) to a polypeptide of the present invention are also included in the present invention. In a specific embodiment, the above-described cross-reactivity is with respect to any single specific antigenic or immunogenic polypeptide, or combination(s) of 2, 3, 4, 5, or more of the specific antigenic and/or immunogenic polypeptides disclosed herein. Further included in the present invention are antibodies which bind polypeptides encoded by polynucleotides which hybridize to a polynucleotide of the present invention under stringent hybridization conditions (as described herein). Antibodies of the present invention may also be described or specified in terms of their binding affinity to a polypeptide of the invention. Preferred binding affinities include those with a dissociation constant or K_d less than 5×10^{-2} M, 10^{-2} M, 5×10^{-3} M, 10^{-3} M, 5×10^{-4} M, 10^{-4} M, 5×10^{-5} M, 10^{-5} M, 5×10^{-6} M, 10^{-6} M, 5×10^{-7} M, 10^{-7} M, 5×10^{-8} M, 10^{-8} M, 5×10^{-9} M, 10^{-9} M, 5×10^{-10} M, 10^{-10} M, 5×10^{-11} M, 10^{-11} M, 5×10^{-12} M, 10^{-12} M, 5×10^{-13} M, 10^{-13} M, 5×10^{-14} M, 10^{-14} M, 5×10^{-15} M, or 10^{-15} M.

[0240] The invention also provides antibodies that competitively inhibit binding of an antibody to an epitope of the invention as determined by any method known in the art for determining competitive binding, for example, the immunoassays described herein. In preferred embodiments, the antibody competitively inhibits binding to the epitope by at least 95%, at least 90%, at least 85 %, at least 80%, at least 75%, at least 70%, at least 60%, or at least 50%.

[0241] Antibodies of the present invention may act as agonists or antagonists of the polypeptides of the present invention. For example, the present invention includes antibodies which disrupt the receptor/ligand interactions with the polypeptides of the invention either partially or fully. Preferably, antibodies of the present invention bind

an antigenic epitope disclosed herein, or a portion thereof. The invention features both receptor-specific antibodies and ligand-specific antibodies. The invention also features receptor-specific antibodies which do not prevent ligand binding but prevent receptor activation. Receptor activation (i.e., signaling) may be determined by techniques described herein or otherwise known in the art. For example, receptor activation can be determined by detecting the phosphorylation (e.g., tyrosine or serine/threonine) of the receptor or its substrate by immunoprecipitation followed by western blot analysis (for example, as described *supra*). In specific embodiments, antibodies are provided that inhibit ligand activity or receptor activity by at least 95%, at least 90%, at least 85%, at least 80%, at least 75%, at least 70%, at least 60%, or at least 50% of the activity in absence of the antibody.

[0242] The invention also features receptor-specific antibodies which both prevent ligand binding and receptor activation as well as antibodies that recognize the receptor-ligand complex, and, preferably, do not specifically recognize the unbound receptor or the unbound ligand. Likewise, included in the invention are neutralizing antibodies which bind the ligand and prevent binding of the ligand to the receptor, as well as antibodies which bind the ligand, thereby preventing receptor activation, but do not prevent the ligand from binding the receptor. Further included in the invention are antibodies which activate the receptor. These antibodies may act as receptor agonists, i.e., potentiate or activate either all or a subset of the biological activities of the ligand-mediated receptor activation, for example, by inducing dimerization of the receptor. The antibodies may be specified as agonists, antagonists or inverse agonists for biological activities comprising the specific biological activities of the peptides of the invention disclosed herein. The above antibody agonists can be made using methods known in the art. See, e.g., PCT publication WO 96/40281; U.S. Patent No. 5,811,097; Deng et al., *Blood* 92(6):1981-1988 (1998); Chen et al., *Cancer Res.* 58(16):3668-3678 (1998); Harrop et al., *J. Immunol.* 161(4):1786-1794 (1998); Zhu et al., *Cancer Res.* 58(15):3209-3214 (1998); Yoon et al., *J. Immunol.* 160(7):3170-3179 (1998); Prat et al., *J. Cell. Sci.* 111(Pt2):237-247 (1998); Pitard et al., *J. Immunol. Methods* 205(2):177-190 (1997); Liautard et al., *Cytokine* 9(4):233-241 (1997); Carlson et al., *J. Biol. Chem.* 272(17):11295-11301 (1997); Taryman et al., *Neuron* 14(4):755-762 (1995); Muller et al., *Structure* 6(9):1153-1167 (1998); Bartunek et al.,

Cytokine 8(1):14-20 (1996) (which are all incorporated by reference herein in their entireties).

[0243] Antibodies of the present invention may be used, for example, to purify, detect, and target the polypeptides of the present invention, including both *in vitro* and *in vivo* diagnostic and therapeutic methods. For example, the antibodies have utility in immunoassays for qualitatively and quantitatively measuring levels of the polypeptides of the present invention in biological samples. See, e.g., Harlow et al., *Antibodies: A Laboratory Manual*, (Cold Spring Harbor Laboratory Press, 2nd ed. 1988); incorporated by reference herein in its entirety.

[0244] As discussed in more detail below, the antibodies of the present invention may be used either alone or in combination with other compositions. The antibodies may further be recombinantly fused to a heterologous polypeptide at the N- or C-terminus or chemically conjugated (including covalent and non-covalent conjugations) to polypeptides or other compositions. For example, antibodies of the present invention may be recombinantly fused or conjugated to molecules useful as labels in detection assays and effector molecules such as heterologous polypeptides, drugs, radionuclides, or toxins. See, e.g., PCT publications WO 92/08495; WO 91/14438; WO 89/12624; U.S. Patent No. 5,314,995; and EP 396,387; the disclosures of which are incorporated herein by reference in their entireties.

[0245] The antibodies of the invention include derivatives that are modified, i.e., by the covalent attachment of any type of molecule to the antibody such that covalent attachment does not prevent the antibody from generating an anti-idiotypic response. For example, but not by way of limitation, the antibody derivatives include antibodies that have been modified, e.g., by glycosylation, acetylation, pegylation, phosphorylation, amidation, derivatization by known protecting/blocking groups, proteolytic cleavage, linkage to a cellular ligand or other protein, etc. Any of numerous chemical modifications may be carried out by known techniques, including, but not limited to specific chemical cleavage, acetylation, formylation, metabolic synthesis of tunicamycin, etc. Additionally, the derivative may contain one or more non-classical amino acids.

[0246] The antibodies of the present invention may be generated by any suitable method known in the art. Polyclonal antibodies to an antigen-of-interest can be

produced by various procedures well known in the art. For example, a polypeptide of the invention can be administered to various host animals including, but not limited to, rabbits, mice, rats, etc. to induce the production of sera containing polyclonal antibodies specific for the antigen. Various adjuvants may be used to increase the immunological response, depending on the host species, and include but are not limited to, Freund's (complete and incomplete), mineral gels such as aluminum hydroxide, surface active substances such as lysolecithin, pluronic polyols, polyanions, peptides, oil emulsions, keyhole limpet hemocyanins, dinitrophenol, and potentially useful human adjuvants such as BCG (bacille Calmette-Guerin) and corynebacterium parvum. Such adjuvants are also well known in the art.

[0247] Monoclonal antibodies can be prepared using a wide variety of techniques known in the art including the use of hybridoma, recombinant, and phage display technologies, or a combination thereof. For example, monoclonal antibodies can be produced using hybridoma techniques including those known in the art and taught, for example, in Harlow et al., *Antibodies: A Laboratory Manual*, (Cold Spring Harbor Laboratory Press, 2nd ed. 1988); Hammerling, et al., in: *Monoclonal Antibodies and T-Cell Hybridomas* 563-681 (Elsevier, N.Y., 1981) (said references incorporated by reference in their entireties). The term "monoclonal antibody" as used herein is not limited to antibodies produced through hybridoma technology. The term "monoclonal antibody" refers to an antibody that is derived from a single clone, including any eukaryotic, prokaryotic, or phage clone, and not the method by which it is produced.

[0248] Methods for producing and screening for specific antibodies using hybridoma technology are routine and well known in the art and are discussed in detail in the Examples. In a non-limiting example, mice can be immunized with a polypeptide of the invention or a cell expressing such peptide. Once an immune response is detected, e.g., antibodies specific for the antigen are detected in the mouse serum, the mouse spleen is harvested and splenocytes isolated. The splenocytes are then fused by well known techniques to any suitable myeloma cells, for example cells from cell line SP20 available from the ATCC. Hybridomas are selected and cloned by limited dilution. The hybridoma clones are then assayed by methods known in the art for cells that secrete antibodies capable of binding a polypeptide of the invention.

Ascites fluid, which generally contains high levels of antibodies, can be generated by immunizing mice with positive hybridoma clones.

[0249] Accordingly, the present invention provides methods of generating monoclonal antibodies as well as antibodies produced by the method comprising culturing a hybridoma cell secreting an antibody of the invention wherein, preferably, the hybridoma is generated by fusing splenocytes isolated from a mouse immunized with an antigen of the invention with myeloma cells and then screening the hybridomas resulting from the fusion for hybridoma clones that secrete an antibody able to bind a polypeptide of the invention.

[0250] Another well known method for producing both polyclonal and monoclonal human B cell lines is transformation using Epstein Barr Virus (EBV). Protocols for generating EBV-transformed B cell lines are commonly known in the art, such as, for example, the protocol outlined in Chapter 7.22 of Current Protocols in Immunology, Coligan et al., Eds., 1994, John Wiley & Sons, NY, which is hereby incorporated in its entirety by reference herein. The source of B cells for transformation is commonly human peripheral blood, but B cells for transformation may also be derived from other sources including, but not limited to, lymph nodes, tonsil, spleen, tumor tissue, and infected tissues. Tissues are generally made into single cell suspensions prior to EBV transformation. Additionally, steps may be taken to either physically remove or inactivate T cells (e.g., by treatment with cyclosporin A) in B cell-containing samples, because T cells from individuals seropositive for anti-EBV antibodies can suppress B cell immortalization by EBV.

[0251] In general, the sample containing human B cells is inoculated with EBV, and cultured for 3-4 weeks. A typical source of EBV is the culture supernatant of the B95-8 cell line (ATCC #VR-1492). Physical signs of EBV transformation can generally be seen towards the end of the 3-4 week culture period. By phase-contrast microscopy, transformed cells may appear large, clear, hairy and tend to aggregate in tight clusters of cells. Initially, EBV lines are generally polyclonal. However, over prolonged periods of cell cultures, EBV lines may become monoclonal or polyclonal as a result of the selective outgrowth of particular B cell clones. Alternatively, polyclonal EBV transformed lines may be subcloned (e.g., by limiting dilution culture) or fused with a suitable fusion partner and plated at limiting dilution to obtain

monoclonal B cell lines. Suitable fusion partners for EBV transformed cell lines include mouse myeloma cell lines (e.g., SP2/0, X63-Ag8.653), heteromyeloma cell lines (human x mouse; e.g., SPAM-8, SBC-H20, and CB-F7), and human cell lines (e.g., GM 1500, SKO-007, RPMI 8226, and KR-4). Thus, the present invention also provides a method of generating polyclonal or monoclonal human antibodies against polypeptides of the invention or fragments thereof, comprising EBV-transformation of human B cells.

[0252] Antibody fragments which recognize specific epitopes may be generated by known techniques. For example, Fab and F(ab')₂ fragments of the invention may be produced by proteolytic cleavage of immunoglobulin molecules, using enzymes such as papain (to produce Fab fragments) or pepsin (to produce F(ab')₂ fragments). F(ab')₂ fragments contain the variable region, the light chain constant region and the CH1 domain of the heavy chain. For example, the antibodies of the present invention can also be generated using various phage display methods known in the art and as discussed in detail in the Examples (e.g., Example 10). In phage display methods, functional antibody domains are displayed on the surface of phage particles which carry the polynucleotide sequences encoding them. In a particular embodiment, such phage can be utilized to display antigen binding domains expressed from a repertoire or combinatorial antibody library (e.g., human or murine). Phage expressing an antigen binding domain that binds the antigen of interest can be selected or identified with antigen, e.g., using labeled antigen or antigen bound or captured to a solid surface or bead. Phage used in these methods are typically filamentous phage including fd and M13 binding domains expressed from phage with Fab, Fv or disulfide stabilized Fv antibody domains recombinantly fused to either the phage gene III or gene VIII protein. Examples of phage display methods that can be used to make the antibodies of the present invention include those disclosed in Brinkman et al., J. Immunol. Methods 182:41-50 (1995); Ames et al., J. Immunol. Methods 184:177-186 (1995); Kettleborough et al., Eur. J. Immunol. 24:952-958 (1994); Persic et al., Gene 187 9-18 (1997); Burton et al., Advances in Immunology 57:191-280 (1994); PCT application No. PCT/GB91/01134; PCT publications WO 90/02809; WO 91/10737; WO 92/01047; WO 92/18619; WO 93/11236; WO 95/15982; WO 95/20401; and U.S. Patent Nos. 5,698,426; 5,223,409; 5,403,484; 5,580,717; 5,427,908; 5,750,753;

5,821,047; 5,571,698; 5,427,908; 5,516,637; 5,780,225; 5,658,727; 5,733,743 and 5,969,108; each of which is incorporated herein by reference in its entirety.

[0253] As described in the above references, after phage selection, the antibody coding regions from the phage can be isolated and used to generate whole antibodies, including human antibodies, or any other desired antigen binding fragment, and expressed in any desired host, including mammalian cells, insect cells, plant cells, yeast, and bacteria, e.g., as described in detail below. For example, techniques to recombinantly produce Fab, Fab' and F(ab')₂ fragments can also be employed using methods known in the art such as those disclosed in PCT publication WO 92/22324; Mullinax et al., BioTechniques 12(6):864-869 (1992); and Sawai et al., AJRI 34:26-34 (1995); and Better et al., Science 240:1041-1043 (1988) (said references incorporated by reference in their entireties).

[0254] Examples of techniques which can be used to produce single-chain Fvs and antibodies include those described in U.S. Patents 4,946,778 and 5,258,498; Huston et al., Methods in Enzymology 203:46-88 (1991); Shu et al., PNAS 90:7995-7999 (1993); and Skerra et al., Science 240:1038-1040 (1988). For some uses, including *in vivo* use of antibodies in humans and *in vitro* detection assays, it may be preferable to use chimeric, humanized, or human antibodies. A chimeric antibody is a molecule in which different portions of the antibody are derived from different animal species, such as antibodies having a variable region derived from a murine monoclonal antibody and a human immunoglobulin constant region. Methods for producing chimeric antibodies are known in the art. See e.g., Morrison, Science 229:1202 (1985); Oi et al., BioTechniques 4:214 (1986); Gillies et al., (1989) J. Immunol. Methods 125:191-202; U.S. Patent Nos. 5,807,715; 4,816,567; and 4,816,397, which are incorporated herein by reference in their entirety. Humanized antibodies are antibody molecules from non-human species antibody that binds the desired antigen having one or more complementarity determining regions (CDRs) from the non-human species and a framework regions from a human immunoglobulin molecule. Often, framework residues in the human framework regions will be substituted with the corresponding residue from the CDR donor antibody to alter, preferably improve, antigen binding. These framework substitutions are identified by methods well known in the art, e.g., by modeling of the interactions of the CDR and framework

residues to identify framework residues important for antigen binding and sequence comparison to identify unusual framework residues at particular positions. (See, e.g., Queen et al., U.S. Patent No. 5,585,089; Riechmann et al., Nature 332:323 (1988), which are incorporated herein by reference in their entireties.) Antibodies can be humanized using a variety of techniques known in the art including, for example, CDR-grafting (EP 239,400; PCT publication WO 91/09967; U.S. Patent Nos. 5,225,539; 5,530,101; and 5,585,089), veneering or resurfacing (EP 592,106; EP 519,596; Padlan, *Molecular Immunology* 28(4/5):489-498 (1991); Studnicka et al., *Protein Engineering* 7(6):805-814 (1994); Roguska et al., *PNAS* 91:969-973 (1994)), and chain shuffling (U.S. Patent No. 5,565,332).

[0255] Completely human antibodies are particularly desirable for therapeutic treatment of human patients. Human antibodies can be made by a variety of methods known in the art including phage display methods described above using antibody libraries derived from human immunoglobulin sequences. See also, U.S. Patent Nos. 4,444,887 and 4,716,111; and PCT publications WO 98/46645, WO 98/50433, WO 98/24893, WO 98/16654, WO 96/34096, WO 96/33735, and WO 91/10741; each of which is incorporated herein by reference in its entirety.

[0256] Human antibodies can also be produced using transgenic mice which are incapable of expressing functional endogenous immunoglobulins, but which can express human immunoglobulin genes. For example, the human heavy and light chain immunoglobulin gene complexes may be introduced randomly or by homologous recombination into mouse embryonic stem cells. Alternatively, the human variable region, constant region, and diversity region may be introduced into mouse embryonic stem cells in addition to the human heavy and light chain genes. The mouse heavy and light chain immunoglobulin genes may be rendered non-functional separately or simultaneously with the introduction of human immunoglobulin loci by homologous recombination. In particular, homozygous deletion of the JH region prevents endogenous antibody production. The modified embryonic stem cells are expanded and microinjected into blastocysts to produce chimeric mice. The chimeric mice are then bred to produce homozygous offspring which express human antibodies. The transgenic mice are immunized in the normal fashion with a selected antigen, e.g., all or a portion of a polypeptide of the invention. Monoclonal antibodies directed against

the antigen can be obtained from the immunized, transgenic mice using conventional hybridoma technology. The human immunoglobulin transgenes harbored by the transgenic mice rearrange during B cell differentiation, and subsequently undergo class switching and somatic mutation. Thus, using such a technique, it is possible to produce therapeutically useful IgG, IgA, IgM and IgE antibodies. For an overview of this technology for producing human antibodies, see Lonberg and Huszar, *Int. Rev. Immunol.* 13:65-93 (1995). For a detailed discussion of this technology for producing human antibodies and human monoclonal antibodies and protocols for producing such antibodies, see, e.g., PCT publications WO 98/24893; WO 92/01047; WO 96/34096; WO 96/33735; European Patent No. 0 598 877; U.S. Patent Nos. 5,413,923; 5,625,126; 5,633,425; 5,569,825; 5,661,016; 5,545,806; 5,814,318; 5,885,793; 5,916,771; 5,939,598; 6,075,181 and 6,114,598, which are incorporated by reference herein in their entirety. In addition, companies such as Abgenix, Inc. (Freemont, CA) and Genpharm (San Jose, CA) can be engaged to provide human antibodies directed against a selected antigen using technology similar to that described above.

[0257] Completely human antibodies which recognize a selected epitope can be generated using a technique referred to as "guided selection." In this approach a selected non-human monoclonal antibody, e.g., a mouse antibody, is used to guide the selection of a completely human antibody recognizing the same epitope. (Jespers et al., *Bio/technology* 12:899-903 (1988)).

[0258] Further, antibodies to the polypeptides of the invention can, in turn, be utilized to generate anti-idiotypic antibodies that "mimic" polypeptides of the invention using techniques well known to those skilled in the art. (See, e.g., Greenspan & Bona, *FASEB J.* 7(5):437-444; (1989) and Nissinoff, J. *Immunol.* 147(8):2429-2438 (1991)). For example, antibodies which bind to and competitively inhibit polypeptide multimerization and/or binding of a polypeptide of the invention to a ligand can be used to generate anti-idiotypes that "mimic" the polypeptide multimerization and/or binding domain and, as a consequence, bind to and neutralize polypeptide and/or its ligand. Such neutralizing anti-idiotypes or Fab fragments of such anti-idiotypes can be used in therapeutic regimens to neutralize polypeptide ligand/receptor. For example, such anti-idiotypic antibodies can be used to bind a polypeptide of the invention and/or to bind its ligand(s)/receptor(s), and thereby block its biological activity.

Alternatively, antibodies which bind to and enhance polypeptide multimerization and/or binding, and/or receptor/ligand multimerization, binding and/or signaling can be used to generate anti-idiotypes that function as agonists of a polypeptide of the invention and/or its ligand/receptor. Such agonistic anti-idiotypes or Fab fragments of such anti-idiotypes can be used in therapeutic regimens as agonists of the polypeptides of the invention or its ligand(s)/receptor(s). For example, such anti-idiotypic antibodies can be used to bind a polypeptide of the invention and/or to bind its ligand(s)/receptor(s), and thereby promote or enhance its biological activity.

[0259] Intrabodies of the invention can be produced using methods known in the art, such as those disclosed and reviewed in Chen et al., Hum. Gene Ther. 5:595-601 (1994); Marasco, W.A., Gene Ther. 4:11-15 (1997); Rondon and Marasco, Annu. Rev. Microbiol. 51:257-283 (1997); Proba et al., J. Mol. Biol. 275:245-253 (1998); Cohen et al., Oncogene 17:2445-2456 (1998); Ohage and Steipe, J. Mol. Biol. 291:1119-1128 (1999); Ohage et al., J. Mol. Biol. 291:1129-1134 (1999); Wirtz and Steipe, Protein Sci. 8:2245-2250 (1999); Zhu et al., J. Immunol. Methods 231:207-222 (1999); and references cited therein.

Polynucleotides Encoding Antibodies

[0260] The invention further provides polynucleotides comprising a nucleotide sequence encoding an antibody of the invention and fragments thereof. The invention also encompasses polynucleotides that hybridize under stringent or alternatively, under lower stringency hybridization conditions, e.g., as defined *supra*, to polynucleotides that encode an antibody, preferably, that specifically binds to a polypeptide of the invention, preferably, an antibody that binds to a polypeptide having the amino acid sequence of SEQ ID NO:Y, to a polypeptide encoded by a portion of SEQ ID NO:X as defined in columns 8 and 9 of Table 2, and/or to a polypeptide encoded by the cDNA contained in Clone ID NO:Z.

[0261] The polynucleotides may be obtained, and the nucleotide sequence of the polynucleotides determined, by any method known in the art. For example, if the nucleotide sequence of the antibody is known, a polynucleotide encoding the antibody may be assembled from chemically synthesized oligonucleotides (e.g., as described in Kutmeier et al., BioTechniques 17:242 (1994)), which, briefly, involves the synthesis

of overlapping oligonucleotides containing portions of the sequence encoding the antibody, annealing and ligating of those oligonucleotides, and then amplification of the ligated oligonucleotides by PCR.

[0262] Alternatively, a polynucleotide encoding an antibody may be generated from nucleic acid from a suitable source. If a clone containing a nucleic acid encoding a particular antibody is not available, but the sequence of the antibody molecule is known, a nucleic acid encoding the immunoglobulin may be chemically synthesized or obtained from a suitable source (e.g., an antibody cDNA library, or a cDNA library generated from, or nucleic acid, preferably poly A+ RNA, isolated from, any tissue or cells expressing the antibody, such as hybridoma cells selected to express an antibody of the invention) by PCR amplification using synthetic primers hybridizable to the 3' and 5' ends of the sequence or by cloning using an oligonucleotide probe specific for the particular gene sequence to identify, e.g., a cDNA clone from a cDNA library that encodes the antibody. Amplified nucleic acids generated by PCR may then be cloned into replicable cloning vectors using any method well known in the art.

[0263] Once the nucleotide sequence and corresponding amino acid sequence of the antibody is determined, the nucleotide sequence of the antibody may be manipulated using methods well known in the art for the manipulation of nucleotide sequences, e.g., recombinant DNA techniques, site directed mutagenesis, PCR, etc. (see, for example, the techniques described in Sambrook et al., 1990, Molecular Cloning, A Laboratory Manual, 2d Ed., Cold Spring Harbor Laboratory, Cold Spring Harbor, NY and Ausubel et al., eds., 1998, Current Protocols in Molecular Biology, John Wiley & Sons, NY, which are both incorporated by reference herein in their entireties), to generate antibodies having a different amino acid sequence, for example to create amino acid substitutions, deletions, and/or insertions.

[0264] In a specific embodiment, the amino acid sequence of the heavy and/or light chain variable domains may be inspected to identify the sequences of the complementarity determining regions (CDRs) by methods that are well known in the art, e.g., by comparison to known amino acid sequences of other heavy and light chain variable regions to determine the regions of sequence hypervariability. Using routine recombinant DNA techniques, one or more of the CDRs may be inserted within framework regions, e.g., into human framework regions to humanize a non-human

antibody, as described *supra*. The framework regions may be naturally occurring or consensus framework regions, and preferably human framework regions (see, e.g., Chothia et al., J. Mol. Biol. 278: 457-479 (1998) for a listing of human framework regions). Preferably, the polynucleotide generated by the combination of the framework regions and CDRs encodes an antibody that specifically binds a polypeptide of the invention. Preferably, as discussed *supra*, one or more amino acid substitutions may be made within the framework regions, and, preferably, the amino acid substitutions improve binding of the antibody to its antigen. Additionally, such methods may be used to make amino acid substitutions or deletions of one or more variable region cysteine residues participating in an intrachain disulfide bond to generate antibody molecules lacking one or more intrachain disulfide bonds. Other alterations to the polynucleotide are encompassed by the present invention and within the skill of the art.

[0265] In addition, techniques developed for the production of "chimeric antibodies" (Morrison et al., Proc. Natl. Acad. Sci. 81:851-855 (1984); Neuberger et al., Nature 312:604-608 (1984); Takeda et al., Nature 314:452-454 (1985)) by splicing genes from a mouse antibody molecule of appropriate antigen specificity together with genes from a human antibody molecule of appropriate biological activity can be used. As described *supra*, a chimeric antibody is a molecule in which different portions are derived from different animal species, such as those having a variable region derived from a murine mAb and a human immunoglobulin constant region, e.g., humanized antibodies.

[0266] Alternatively, techniques described for the production of single chain antibodies (U.S. Patent No. 4,946,778; Bird, Science 242:423-42 (1988); Huston et al., Proc. Natl. Acad. Sci. USA 85:5879-5883 (1988); and Ward et al., Nature 334:544-54 (1989)) can be adapted to produce single chain antibodies. Single chain antibodies are formed by linking the heavy and light chain fragments of the Fv region via an amino acid bridge, resulting in a single chain polypeptide. Techniques for the assembly of functional Fv fragments in *E. coli* may also be used (Skerra et al., Science 242:1038-1041 (1988)).

Methods of Producing Antibodies

[0267] The antibodies of the invention can be produced by any method known in the art for the synthesis of antibodies, in particular, by chemical synthesis or preferably, by recombinant expression techniques. Methods of producing antibodies include, but are not limited to, hybridoma technology, EBV transformation, and other methods discussed herein as well as through the use recombinant DNA technology, as discussed below.

[0268] Recombinant expression of an antibody of the invention, or fragment, derivative or analog thereof, (e.g., a heavy or light chain of an antibody of the invention or a single chain antibody of the invention), requires construction of an expression vector containing a polynucleotide that encodes the antibody. Once a polynucleotide encoding an antibody molecule or a heavy or light chain of an antibody, or portion thereof (preferably containing the heavy or light chain variable domain), of the invention has been obtained, the vector for the production of the antibody molecule may be produced by recombinant DNA technology using techniques well known in the art. Thus, methods for preparing a protein by expressing a polynucleotide containing an antibody encoding nucleotide sequence are described herein. Methods which are well known to those skilled in the art can be used to construct expression vectors containing antibody coding sequences and appropriate transcriptional and translational control signals. These methods include, for example, *in vitro* recombinant DNA techniques, synthetic techniques, and *in vivo* genetic recombination. The invention, thus, provides replicable vectors comprising a nucleotide sequence encoding an antibody molecule of the invention, or a heavy or light chain thereof, or a heavy or light chain variable domain, operably linked to a promoter. Such vectors may include the nucleotide sequence encoding the constant region of the antibody molecule (see, e.g., PCT Publication WO 86/05807; PCT Publication WO 89/01036; and U.S. Patent No. 5,122,464) and the variable domain of the antibody may be cloned into such a vector for expression of the entire heavy or light chain.

[0269] The expression vector is transferred to a host cell by conventional techniques and the transfected cells are then cultured by conventional techniques to produce an antibody of the invention. Thus, the invention includes host cells containing a polynucleotide encoding an antibody of the invention, or a heavy or light

chain thereof, or a single chain antibody of the invention, operably linked to a heterologous promoter. In preferred embodiments for the expression of double-chained antibodies, vectors encoding both the heavy and light chains may be co-expressed in the host cell for expression of the entire immunoglobulin molecule, as detailed below.

[0270] A variety of host-expression vector systems may be utilized to express the antibody molecules of the invention. Such host-expression systems represent vehicles by which the coding sequences of interest may be produced and subsequently purified, but also represent cells which may, when transformed or transfected with the appropriate nucleotide coding sequences, express an antibody molecule of the invention in situ. These include but are not limited to microorganisms such as bacteria (e.g., *E. coli*, *B. subtilis*) transformed with recombinant bacteriophage DNA, plasmid DNA or cosmid DNA expression vectors containing antibody coding sequences; yeast (e.g., *Saccharomyces*, *Pichia*) transformed with recombinant yeast expression vectors containing antibody coding sequences; insect cell systems infected with recombinant virus expression vectors (e.g., baculovirus) containing antibody coding sequences; plant cell systems infected with recombinant virus expression vectors (e.g., cauliflower mosaic virus, CaMV; tobacco mosaic virus, TMV) or transformed with recombinant plasmid expression vectors (e.g., Ti plasmid) containing antibody coding sequences; or mammalian cell systems (e.g., COS, CHO, BHK, 293, 3T3 cells) harboring recombinant expression constructs containing promoters derived from the genome of mammalian cells (e.g., metallothionein promoter) or from mammalian viruses (e.g., the adenovirus late promoter; the vaccinia virus 7.5K promoter). Preferably, bacterial cells such as *Escherichia coli*, and more preferably, eukaryotic cells, especially for the expression of whole recombinant antibody molecule, are used for the expression of a recombinant antibody molecule. For example, mammalian cells such as Chinese hamster ovary cells (CHO), in conjunction with a vector such as the major intermediate early gene promoter element from human cytomegalovirus is an effective expression system for antibodies (Foecking et al., *Gene* 45:101 (1986); Cockett et al., *Bio/Technology* 8:2 (1990)).

[0271] In bacterial systems, a number of expression vectors may be advantageously selected depending upon the use intended for the antibody molecule

being expressed. For example, when a large quantity of such a protein is to be produced, for the generation of pharmaceutical compositions of an antibody molecule, vectors which direct the expression of high levels of fusion protein products that are readily purified may be desirable. Such vectors include, but are not limited, to the *E. coli* expression vector pUR278 (Ruther et al., EMBO J. 2:1791 (1983)), in which the antibody coding sequence may be ligated individually into the vector in frame with the lac Z coding region so that a fusion protein is produced; pIN vectors (Inouye & Inouye, Nucleic Acids Res. 13:3101-3109 (1985); Van Heeke & Schuster, J. Biol. Chem. 24:5503-5509 (1989)); and the like. pGEX vectors may also be used to express foreign polypeptides as fusion proteins with glutathione S-transferase (GST). In general, such fusion proteins are soluble and can easily be purified from lysed cells by adsorption and binding to matrix glutathione-agarose beads followed by elution in the presence of free glutathione. The pGEX vectors are designed to include thrombin or factor Xa protease cleavage sites so that the cloned target gene product can be released from the GST moiety.

[0272] In an insect system, *Autographa californica* nuclear polyhedrosis virus (AcNPV) is used as a vector to express foreign genes. The virus grows in *Spodoptera frugiperda* cells. The antibody coding sequence may be cloned individually into non-essential regions (for example the polyhedrin gene) of the virus and placed under control of an AcNPV promoter (for example the polyhedrin promoter).

[0273] In mammalian host cells, a number of viral-based expression systems may be utilized. In cases where an adenovirus is used as an expression vector, the antibody coding sequence of interest may be ligated to an adenovirus transcription/translation control complex, e.g., the late promoter and tripartite leader sequence. This chimeric gene may then be inserted in the adenovirus genome by *in vitro* or *in vivo* recombination. Insertion in a non-essential region of the viral genome (e.g., region E1 or E3) will result in a recombinant virus that is viable and capable of expressing the antibody molecule in infected hosts. (e.g., see Logan & Shenk, Proc. Natl. Acad. Sci. USA 81:355-359 (1984)). Specific initiation signals may also be required for efficient translation of inserted antibody coding sequences. These signals include the ATG initiation codon and adjacent sequences. Furthermore, the initiation codon must be in phase with the reading frame of the desired coding sequence to

ensure translation of the entire insert. These exogenous translational control signals and initiation codons can be of a variety of origins, both natural and synthetic. The efficiency of expression may be enhanced by the inclusion of appropriate transcription enhancer elements, transcription terminators, etc. (see Bittner et al., *Methods in Enzymol.* 153:51-544 (1987)).

[0274] In addition, a host cell strain may be chosen which modulates the expression of the inserted sequences, or modifies and processes the gene product in the specific fashion desired. Such modifications (e.g., glycosylation) and processing (e.g., cleavage) of protein products may be important for the function of the protein. Different host cells have characteristic and specific mechanisms for the post-translational processing and modification of proteins and gene products. Appropriate cell lines or host systems can be chosen to ensure the correct modification and processing of the foreign protein expressed. To this end, eukaryotic host cells which possess the cellular machinery for proper processing of the primary transcript, glycosylation, and phosphorylation of the gene product may be used. Such mammalian host cells include but are not limited to CHO, VERO, BHK, HeLa, COS, MDCK, 293, 3T3, WI38, and in particular, breast cancer cell lines such as, for example, BT483, Hs578T, HTB2, BT20 and T47D, and normal mammary gland cell line such as, for example, CRL7030 and Hs578Bst.

[0275] For long-term, high-yield production of recombinant proteins, stable expression is preferred. For example, cell lines which stably express the antibody molecule may be engineered. Rather than using expression vectors which contain viral origins of replication, host cells can be transformed with DNA controlled by appropriate expression control elements (e.g., promoter, enhancer, sequences, transcription terminators, polyadenylation sites, etc.), and a selectable marker. Following the introduction of the foreign DNA, engineered cells may be allowed to grow for 1-2 days in an enriched media, and then are switched to a selective media. The selectable marker in the recombinant plasmid confers resistance to the selection and allows cells to stably integrate the plasmid into their chromosomes and grow to form foci which in turn can be cloned and expanded into cell lines. This method may advantageously be used to engineer cell lines which express the antibody molecule.

Such engineered cell lines may be particularly useful in screening and evaluation of compounds that interact directly or indirectly with the antibody molecule.

[0276] A number of selection systems may be used, including but not limited to the herpes simplex virus thymidine kinase (Wigler et al., *Cell* 11:223 (1977)), hypoxanthine-guanine phosphoribosyltransferase (Szybalska & Szybalski, *Proc. Natl. Acad. Sci. USA* 48:202 (1992)), and adenine phosphoribosyltransferase (Lowy et al., *Cell* 22:817 (1980)) genes can be employed in tk-, hgp^rt- or ap^rt- cells, respectively. Also, antimetabolite resistance can be used as the basis of selection for the following genes: dhfr, which confers resistance to methotrexate (Wigler et al., *Natl. Acad. Sci. USA* 77:357 (1980); O'Hare et al., *Proc. Natl. Acad. Sci. USA* 78:1527 (1981)); gpt, which confers resistance to mycophenolic acid (Mulligan & Berg, *Proc. Natl. Acad. Sci. USA* 78:2072 (1981)); neo, which confers resistance to the aminoglycoside G-418 (*Clinical Pharmacy* 12:488-505; Wu and Wu, *Biotherapy* 3:87-95 (1991); Tolstoshev, *Ann. Rev. Pharmacol. Toxicol.* 32:573-596 (1993); Mulligan, *Science* 260:926-932 (1993); and Morgan and Anderson, *Ann. Rev. Biochem.* 62:191-217 (1993); TIB TECH 11(5):155-215 (1993)); and hyg^r, which confers resistance to hygromycin (Santerre et al., *Gene* 30:147 (1984)). Methods commonly known in the art of recombinant DNA technology may be routinely applied to select the desired recombinant clone, and such methods are described, for example, in Ausubel et al. (eds.), *Current Protocols in Molecular Biology*, John Wiley & Sons, NY (1993); Kriegler, *Gene Transfer and Expression, A Laboratory Manual*, Stockton Press, NY (1990); and in Chapters 12 and 13, Dracopoli et al. (eds), *Current Protocols in Human Genetics*, John Wiley & Sons, NY (1994); Colberre-Garapin et al., *J. Mol. Biol.* 150:1 (1981), which are incorporated by reference herein in their entireties.

[0277] The expression levels of an antibody molecule can be increased by vector amplification (for a review, see Bebbington and Hentschel, *The use of vectors based on gene amplification for the expression of cloned genes in mammalian cells in DNA cloning*, Vol.3. (Academic Press, New York, 1987)). When a marker in the vector system expressing antibody is amplifiable, increase in the level of inhibitor present in culture of host cell will increase the number of copies of the marker gene. Since the amplified region is associated with the antibody gene, production of the antibody will also increase (Crouse et al., *Mol. Cell. Biol.* 3:257 (1983)).

[0278] Vectors which use glutamine synthase (GS) or DHFR as the selectable markers can be amplified in the presence of the drugs methionine sulfoximine or methotrexate, respectively. An advantage of glutamine synthase based vectors are the availability of cell lines (e.g., the murine myeloma cell line, NS0) which are glutamine synthase negative. Glutamine synthase expression systems can also function in glutamine synthase expressing cells (e.g., Chinese Hamster Ovary (CHO) cells) by providing additional inhibitor to prevent the functioning of the endogenous gene. A glutamine synthase expression system and components thereof are detailed in PCT publications: WO87/04462; WO86/05807; WO89/01036; WO89/10404; and WO91/06657 which are incorporated in their entireties by reference herein. Additionally, glutamine synthase expression vectors that may be used according to the present invention are commercially available from suppliers, including, for example Lonza Biologics, Inc. (Portsmouth, NH). Expression and production of monoclonal antibodies using a GS expression system in murine myeloma cells is described in Bebbington et al., *Bio/technology* 10:169(1992) and in Biblia and Robinson *Biotechnol. Prog.* 11:1 (1995) which are incorporated in their entireties by reference herein.

[0279] The host cell may be co-transfected with two expression vectors of the invention, the first vector encoding a heavy chain derived polypeptide and the second vector encoding a light chain derived polypeptide. The two vectors may contain identical selectable markers which enable equal expression of heavy and light chain polypeptides. Alternatively, a single vector may be used which encodes, and is capable of expressing, both heavy and light chain polypeptides. In such situations, the light chain should be placed before the heavy chain to avoid an excess of toxic free heavy chain (Proudfoot, *Nature* 322:52 (1986); Kohler, *Proc. Natl. Acad. Sci. USA* 77:2197 (1980)). The coding sequences for the heavy and light chains may comprise cDNA or genomic DNA.

[0280] Once an antibody molecule of the invention has been produced by an animal, chemically synthesized, or recombinantly expressed, it may be purified by any method known in the art for purification of an immunoglobulin molecule, for example, by chromatography (e.g., ion exchange, affinity, particularly by affinity for the specific antigen after Protein A, and sizing column chromatography), centrifugation,

differential solubility, or by any other standard technique for the purification of proteins. In addition, the antibodies of the present invention or fragments thereof can be fused to heterologous polypeptide sequences described herein or otherwise known in the art, to facilitate purification.

[0281] The present invention encompasses antibodies recombinantly fused or chemically conjugated (including both covalently and non-covalently conjugations) to a polypeptide (or portion thereof, preferably at least 10, 20, 30, 40, 50, 60, 70, 80, 90 or 100 amino acids of the polypeptide) of the present invention to generate fusion proteins. The fusion does not necessarily need to be direct, but may occur through linker sequences. The antibodies may be specific for antigens other than polypeptides (or portion thereof, preferably at least 10, 20, 30, 40, 50, 60, 70, 80, 90 or 100 amino acids of the polypeptide) of the present invention. For example, antibodies may be used to target the polypeptides of the present invention to particular cell types, either *in vitro* or *in vivo*, by fusing or conjugating the polypeptides of the present invention to antibodies specific for particular cell surface receptors. Antibodies fused or conjugated to the polypeptides of the present invention may also be used in *in vitro* immunoassays and purification methods using methods known in the art. See e.g., Harbor et al., *supra*, and PCT publication WO 93/21232; EP 439,095; Naramura et al., Immunol. Lett. 39:91-99 (1994); U.S. Patent 5,474,981; Gillies et al., PNAS 89:1428-1432 (1992); Fell et al., J. Immunol. 146:2446-2452 (1991), which are incorporated by reference in their entireties.

[0282] The present invention further includes compositions comprising the polypeptides of the present invention fused or conjugated to antibody domains other than the variable regions. For example, the polypeptides of the present invention may be fused or conjugated to an antibody Fc region, or portion thereof. The antibody portion fused to a polypeptide of the present invention may comprise the constant region, hinge region, CH1 domain, CH2 domain, and CH3 domain or any combination of whole domains or portions thereof. The polypeptides may also be fused or conjugated to the above antibody portions to form multimers. For example, Fc portions fused to the polypeptides of the present invention can form dimers through disulfide bonding between the Fc portions. Higher multimeric forms can be made by fusing the polypeptides to portions of IgA and IgM. Methods for fusing or

conjugating the polypeptides of the present invention to antibody portions are known in the art. See, e.g., U.S. Patent Nos. 5,336,603; 5,622,929; 5,359,046; 5,349,053; 5,447,851; 5,112,946; EP 307,434; EP 367,166; PCT publications WO 96/04388; WO 91/06570; Ashkenazi et al., Proc. Natl. Acad. Sci. USA 88:10535-10539 (1991); Zheng et al., J. Immunol. 154:5590-5600 (1995); and Vil et al., Proc. Natl. Acad. Sci. USA 89:11337-11341 (1992) (said references incorporated by reference in their entireties).

[0283] As discussed, *supra*, the polypeptides corresponding to a polypeptide, polypeptide fragment, or a variant of SEQ ID NO:Y may be fused or conjugated to the above antibody portions to increase the *in vivo* half life of the polypeptides or for use in immunoassays using methods known in the art. Further, the polypeptides corresponding to SEQ ID NO:Y may be fused or conjugated to the above antibody portions to facilitate purification. One reported example describes chimeric proteins consisting of the first two domains of the human CD4-polypeptide and various domains of the constant regions of the heavy or light chains of mammalian immunoglobulins. See EP 394,827; Traunecker et al., Nature 331:84-86 (1988). The polypeptides of the present invention fused or conjugated to an antibody having disulfide-linked dimeric structures (due to the IgG) may also be more efficient in binding and neutralizing other molecules, than the monomeric secreted protein or protein fragment alone. See, for example, Fountoulakis et al., J. Biochem. 270:3958-3964 (1995). In many cases, the Fc part in a fusion protein is beneficial in therapy and diagnosis, and thus can result in, for example, improved pharmacokinetic properties. See, for example, EP A 232,262. Alternatively, deleting the Fc part after the fusion protein has been expressed, detected, and purified, would be desired. For example, the Fc portion may hinder therapy and diagnosis if the fusion protein is used as an antigen for immunizations. In drug discovery, for example, human proteins, such as hIL-5, have been fused with Fc portions for the purpose of high-throughput screening assays to identify antagonists of hIL-5. (See, Bennett et al., J. Molecular Recognition 8:52-58 (1995); Johanson et al., J. Biol. Chem. 270:9459-9471 (1995)).

[0284] Moreover, the antibodies or fragments thereof of the present invention can be fused to marker sequences, such as a peptide to facilitate purification. In preferred embodiments, the marker amino acid sequence is a hexa-histidine peptide, such as the

tag provided in a pQE vector (QIAGEN, Inc., 9259 Eton Avenue, Chatsworth, CA, 91311), among others, many of which are commercially available. As described in Gentz et al., Proc. Natl. Acad. Sci. USA 86:821-824 (1989), for instance, hexahistidine provides for convenient purification of the fusion protein. Other peptide tags useful for purification include, but are not limited to, the "HA" tag, which corresponds to an epitope derived from the influenza hemagglutinin protein (Wilson et al., Cell 37:767 (1984)) and the "flag" tag.

[0285] The present invention further encompasses antibodies or fragments thereof conjugated to a diagnostic or therapeutic agent. The antibodies can be used diagnostically to, for example, monitor the development or progression of a tumor as part of a clinical testing procedure to, e.g., determine the efficacy of a given treatment regimen. Detection can be facilitated by coupling the antibody to a detectable substance. Examples of detectable substances include various enzymes, prosthetic groups, fluorescent materials, luminescent materials, bioluminescent materials, radioactive materials, positron emitting metals using various positron emission tomographies, and nonradioactive paramagnetic metal ions. The detectable substance may be coupled or conjugated either directly to the antibody (or fragment thereof) or indirectly, through an intermediate (such as, for example, a linker known in the art) using techniques known in the art. See, for example, U.S. Patent No. 4,741,900 for metal ions which can be conjugated to antibodies for use as diagnostics according to the present invention.

[0286] Further, an antibody or fragment thereof may be conjugated to a therapeutic moiety such as a cytotoxin, e.g., a cytostatic or cytocidal agent, a therapeutic agent or a radioactive metal ion, e.g., alpha-emitters such as, for example, ²¹³Bi. A cytotoxin or cytotoxic agent includes any agent that is detrimental to cells. Examples include paclitaxol, cytochalasin B, gramicidin D, ethidium bromide, emetine, mitomycin, etoposide, teniposide, vincristine, vinblastine, colchicin, doxorubicin, daunorubicin, dihydroxy anthracin dione, mitoxantrone, mithramycin, actinomycin D, 1-dehydrotestosterone, glucocorticoids, procaine, tetracaine, lidocaine, propranolol, and puromycin and analogs or homologs thereof. Therapeutic agents include, but are not limited to, antimetabolites (e.g., methotrexate, 6-mercaptopurine, 6-thioguanine, cytarabine, 5-fluorouracil decarbazine), alkylating

agents (e.g., mechlorethamine, thioepa chlorambucil, melphalan, carmustine (BSNU) and lomustine (CCNU), cyclophosphamide, busulfan, dibromomannitol, streptozotocin, mitomycin C, and cis-dichlorodiamine platinum (II) (DDP) cisplatin), anthracyclines (e.g., daunorubicin (formerly daunomycin) and doxorubicin), antibiotics (e.g., dactinomycin (formerly actinomycin), bleomycin, mithramycin, and anthramycin (AMC)), and anti-mitotic agents (e.g., vincristine and vinblastine).

[0287] The conjugates of the invention can be used for modifying a given biological response, the therapeutic agent or drug moiety is not to be construed as limited to classical chemical therapeutic agents. For example, the drug moiety may be a protein or polypeptide possessing a desired biological activity. Such proteins may include, for example, a toxin such as abrin, ricin A, pseudomonas exotoxin, or diphtheria toxin; a protein such as tumor necrosis factor, α -interferon, β -interferon, nerve growth factor, platelet derived growth factor, tissue plasminogen activator, an apoptotic agent, e.g., TNF- α , TNF- β , AIM I (See, International Publication No. WO 97/33899), AIM II (See, International Publication No. WO 97/34911), Fas Ligand (Takahashi *et al.*, *Int. Immunol.*, 6:1567-1574 (1994)), VEGF (See, International Publication No. WO 99/23105), a thrombotic agent or an anti-angiogenic agent, e.g., angiostatin or endostatin; or, biological response modifiers such as, for example, lymphokines, interleukin-1 ("IL-1"), interleukin-2 ("IL-2"), interleukin-6 ("IL-6"), granulocyte macrophage colony stimulating factor ("GM-CSF"), granulocyte colony stimulating factor ("G-CSF"), or other growth factors.

[0288] Antibodies may also be attached to solid supports, which are particularly useful for immunoassays or purification of the target antigen. Such solid supports include, but are not limited to, glass, cellulose, polyacrylamide, nylon, polystyrene, polyvinyl chloride or polypropylene.

[0289] Techniques for conjugating such therapeutic moiety to antibodies are well known. See, for example, Arnon *et al.*, "Monoclonal Antibodies For Immunotargeting Of Drugs In Cancer Therapy", in *Monoclonal Antibodies And Cancer Therapy*, Reisfeld *et al.* (eds.), pp. 243-56 (Alan R. Liss, Inc. 1985); Hellstrom *et al.*, "Antibodies For Drug Delivery", in *Controlled Drug Delivery* (2nd Ed.), Robinson *et al.* (eds.), pp. 623-53 (Marcel Dekker, Inc. 1987); Thorpe, "Antibody Carriers Of Cytotoxic Agents In Cancer Therapy: A Review", in *Monoclonal*

Antibodies '84: Biological And Clinical Applications, Pinchera et al. (eds.), pp. 475-506 (1985); "Analysis, Results, And Future Prospective Of The Therapeutic Use Of Radiolabeled Antibody In Cancer Therapy", in Monoclonal Antibodies For Cancer Detection And Therapy, Baldwin et al. (eds.), pp. 303-16 (Academic Press 1985), and Thorpe et al., "The Preparation And Cytotoxic Properties Of Antibody-Toxin Conjugates", Immunol. Rev. 62:119-58 (1982).

[0290] Alternatively, an antibody can be conjugated to a second antibody to form an antibody heteroconjugate as described by Segal in U.S. Patent No. 4,676,980, which is incorporated herein by reference in its entirety.

[0291] An antibody, with or without a therapeutic moiety conjugated to it, administered alone or in combination with cytotoxic factor(s) and/or cytokine(s) can be used as a therapeutic.

Immunophenotyping

[0292] The antibodies of the invention may be utilized for immunophenotyping of cell lines and biological samples. Translation products of the genes of the present invention may be useful as cell specific markers, or more specifically as cellular markers that are differentially expressed at various stages of differentiation and/or maturation of particular cell types. Monoclonal antibodies directed against a specific epitope, or combination of epitopes, will allow for the screening of cellular populations expressing the marker. Various techniques can be utilized using monoclonal antibodies to screen for cellular populations expressing the marker(s), and include magnetic separation using antibody-coated magnetic beads, "panning" with antibody attached to a solid matrix (i.e., plate), and flow cytometry (See, e.g., U.S. Patent 5,985,660; and Morrison et al., Cell, 96:737-49 (1999)).

[0293] These techniques allow for the screening of particular populations of cells, such as might be found with hematological malignancies (i.e. minimal residual disease (MRD) in acute leukemic patients) and "non-self" cells in transplantations to prevent Graft-versus-Host Disease (GVHD). Alternatively, these techniques allow for the screening of hematopoietic stem and progenitor cells capable of undergoing proliferation and/or differentiation, as might be found in human umbilical cord blood.

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nylon, blocking the membrane in blocking solution (e.g., PBS with 3% BSA or non-fat milk), washing the membrane in washing buffer (e.g., PBS-Tween 20), blocking the membrane with primary antibody (the antibody of interest) diluted in blocking buffer, washing the membrane in washing buffer, blocking the membrane with a secondary antibody (which recognizes the primary antibody, e.g., an anti-human antibody) conjugated to an enzymatic substrate (e.g., horseradish peroxidase or alkaline phosphatase) or radioactive molecule (e.g., ^{32}P or ^{125}I) diluted in blocking buffer, washing the membrane in wash buffer, and detecting the presence of the antigen. One of skill in the art would be knowledgeable as to the parameters that can be modified to increase the signal detected and to reduce the background noise. For further discussion regarding western blot protocols see, e.g., Ausubel et al., eds., (1994), Current Protocols in Molecular Biology, Vol. 1, John Wiley & Sons, Inc., New York, section 10.8.1.

[0297] ELISAs comprise preparing antigen, coating the well of a 96 well microtiter plate with the antigen, adding the antibody of interest conjugated to a detectable compound such as an enzymatic substrate (e.g., horseradish peroxidase or alkaline phosphatase) to the well and incubating for a period of time, and detecting the presence of the antigen. In ELISAs the antibody of interest does not have to be conjugated to a detectable compound; instead, a second antibody (which recognizes the antibody of interest) conjugated to a detectable compound may be added to the well. Further, instead of coating the well with the antigen, the antibody may be coated to the well. In this case, a second antibody conjugated to a detectable compound may be added following the addition of the antigen of interest to the coated well. One of skill in the art would be knowledgeable as to the parameters that can be modified to increase the signal detected as well as other variations of ELISAs known in the art. For further discussion regarding ELISAs see, e.g., Ausubel et al., eds., (1994), Current Protocols in Molecular Biology, Vol. 1, John Wiley & Sons, Inc., New York, section 11.2.1.

[0298] The binding affinity of an antibody to an antigen and the off-rate of an antibody-antigen interaction can be determined by competitive binding assays. One example of a competitive binding assay is a radioimmunoassay comprising the incubation of labeled antigen (e.g., ^3H or ^{125}I) with the antibody of interest in the

presence of increasing amounts of unlabeled antigen, and the detection of the antibody bound to the labeled antigen. The affinity of the antibody of interest for a particular antigen and the binding off-rates can be determined from the data by scatchard plot analysis. Competition with a second antibody can also be determined using radioimmunoassays. In this case, the antigen is incubated with antibody of interest conjugated to a labeled compound (e.g., ^3H or ^{125}I) in the presence of increasing amounts of an unlabeled second antibody.

[0299] Antibodies of the invention may be characterized using immunocytochemistry methods on cells (e.g., mammalian cells, such as CHO cells) transfected with a vector enabling the expression of a reproductive system antigen or with vector alone using techniques commonly known in the art. Antibodies that bind reproductive system antigen transfected cells, but not vector-only transfected cells, are reproductive system antigen specific.

Therapeutic Uses

[0300] The present invention is further directed to antibody-based therapies which involve administering antibodies of the invention to an animal, preferably a mammal, and most preferably a human, patient for treating one or more of the disclosed diseases, disorders, or conditions. Therapeutic compounds of the invention include, but are not limited to, antibodies of the invention (including fragments, analogs and derivatives thereof as described herein) and nucleic acids encoding antibodies of the invention (including fragments, analogs and derivatives thereof and anti-idiotypic antibodies as described herein). The antibodies of the invention can be used to treat, inhibit or prevent diseases, disorders or conditions associated with aberrant expression and/or activity of a polypeptide of the invention, including, but not limited to, any one or more of the diseases, disorders, or conditions described herein. The treatment and/or prevention of diseases, disorders, or conditions associated with aberrant expression and/or activity of a polypeptide of the invention includes, but is not limited to, alleviating symptoms associated with those diseases, disorders or conditions. Antibodies of the invention may be provided in pharmaceutically acceptable compositions as known in the art or as described herein.

[0301] In a specific and preferred embodiment, the present invention is directed to antibody-based therapies which involve administering antibodies of the invention to an animal, preferably a mammal, and most preferably a human, patient for treating one or more of the diseases, disorders, or conditions of the reproductive system, including, but not limited to, injuries and trauma, infections, neoplastic disorders, congenital defects, and diseases or disorders which result in infertility, complications with pregnancy, labor, or parturition, postpartum difficulties, and as listed below in the section entitled "Reproductive System Disorders". Therapeutic compounds of the invention include, but are not limited to, antibodies of the invention (e.g., antibodies directed to the full length protein expressed on the cell surface of a mammalian cell; antibodies directed to an epitope of a reproductive system associated polypeptide of the invention (such as, a linear epitope (shown in Table 1A, column 6) or a conformational epitope), including fragments, analogs and derivatives thereof as described herein) and nucleic acids encoding antibodies of the invention (including fragments, analogs and derivatives thereof and anti-idiotypic antibodies as described herein). The antibodies of the invention can be used to treat, inhibit or prevent diseases, disorders or conditions associated with aberrant expression and/or activity of a polypeptide of the invention, including, but not limited to, any one or more of the diseases, disorders, or conditions of the reproductive system described herein. The treatment and/or prevention of diseases, disorders, or conditions of the reproductive system associated with aberrant expression and/or activity of a polypeptide of the invention includes, but is not limited to, alleviating symptoms associated with those diseases, disorders or conditions. Antibodies of the invention may be provided in pharmaceutically acceptable compositions as known in the art or as described herein.

[0302] A summary of the ways in which the antibodies of the present invention may be used therapeutically includes binding polynucleotides or polypeptides of the present invention locally or systemically in the body or by direct cytotoxicity of the antibody, e.g. as mediated by complement (CDC) or by effector cells (ADCC). Some of these approaches are described in more detail below. Armed with the teachings provided herein, one of ordinary skill in the art will know how to use the antibodies of the present invention for diagnostic, monitoring or therapeutic purposes without undue experimentation.

[0303] The antibodies of this invention may be advantageously utilized in combination with other monoclonal or chimeric antibodies, or with lymphokines or hematopoietic growth factors (such as, e.g., IL-2, IL-3 and IL-7), for example, which serve to increase the number or activity of effector cells which interact with the antibodies.

[0304] The antibodies of the invention may be administered alone or in combination with other types of treatments (e.g., radiation therapy, chemotherapy, hormonal therapy, immunotherapy and anti-tumor agents). Generally, administration of products of a species origin or species reactivity (in the case of antibodies) that is the same species as that of the patient is preferred. Thus, in a preferred embodiment, human antibodies, fragments derivatives, analogs, or nucleic acids, are administered to a human patient for therapy or prophylaxis.

[0305] It is preferred to use high affinity and/or potent *in vivo* inhibiting and/or neutralizing antibodies against polypeptides or polynucleotides of the present invention, fragments or regions thereof, for both immunoassays directed to and therapy of disorders related to polynucleotides or polypeptides, including fragments thereof, of the present invention. Such antibodies, fragments, or regions, will preferably have an affinity for polynucleotides or polypeptides of the invention, including fragments thereof. Preferred binding affinities include those with a dissociation constant or K_d less than 5×10^{-2} M, 10^{-2} M, 5×10^{-3} M, 10^{-3} M, 5×10^{-4} M, 10^{-4} M, 5×10^{-5} M, 10^{-5} M, 5×10^{-6} M, 10^{-6} M, 5×10^{-7} M, 10^{-7} M, 5×10^{-8} M, 10^{-8} M, 5×10^{-9} M, 10^{-9} M, 5×10^{-10} M, 10^{-10} M, 5×10^{-11} M, 10^{-11} M, 5×10^{-12} M, 10^{-12} M, 5×10^{-13} M, 10^{-13} M, 5×10^{-14} M, 10^{-14} M, 5×10^{-15} M, and 10^{-15} M.

Gene Therapy

[0306] In a specific embodiment, nucleic acids comprising sequences encoding antibodies or functional derivatives thereof, are administered to treat, inhibit or prevent a disease or disorder associated with aberrant expression and/or activity of a polypeptide of the invention, by way of gene therapy. Gene therapy refers to therapy performed by the administration to a subject of an expressed or expressible nucleic acid. In this embodiment of the invention, the nucleic acids produce their encoded protein that mediates a therapeutic effect.

[0307] Any of the methods for gene therapy available in the art can be used according to the present invention. Exemplary methods are described below.

[0308] For general reviews of the methods of gene therapy, see Goldspiel et al., Clinical Pharmacy 12:488-505 (1993); Wu and Wu, Biotherapy 3:87-95 (1991); Tolstoshev, Ann. Rev. Pharmacol. Toxicol. 32:573-596 (1993); Mulligan, Science 260:926-932 (1993); and Morgan and Anderson, Ann. Rev. Biochem. 62:191-217 (1993); May, TIBTECH 11(5):155-215 (1993). Methods commonly known in the art of recombinant DNA technology which can be used are described in Ausubel et al. (eds.), Current Protocols in Molecular Biology, John Wiley & Sons, NY (1993); and Kriegler, Gene Transfer and Expression, A Laboratory Manual, Stockton Press, NY (1990).

[0309] In a preferred embodiment, the compound comprises nucleic acid sequences encoding an antibody, said nucleic acid sequences being part of expression vectors that express the antibody or fragments or chimeric proteins or heavy or light chains thereof in a suitable host. In particular, such nucleic acid sequences have promoters operably linked to the antibody coding region, said promoter being inducible or constitutive, and, optionally, tissue-specific. In another particular embodiment, nucleic acid molecules are used in which the antibody coding sequences and any other desired sequences are flanked by regions that promote homologous recombination at a desired site in the genome, thus providing for intrachromosomal expression of the antibody encoding nucleic acids (Koller and Smithies, Proc. Natl. Acad. Sci. USA 86:8932-8935 (1989); Zijlstra et al., Nature 342:435-438 (1989)). In specific embodiments, the expressed antibody molecule is a single chain antibody; alternatively, the nucleic acid sequences include sequences encoding both the heavy and light chains, or fragments thereof, of the antibody.

[0310] Delivery of the nucleic acids into a patient may be either direct, in which case the patient is directly exposed to the nucleic acid or nucleic acid-carrying vectors, or indirect, in which case, cells are first transformed with the nucleic acids *in vitro*, then transplanted into the patient. These two approaches are known, respectively, as *in vivo* or *ex vivo* gene therapy.

[0311] In a specific embodiment, the nucleic acid sequences are directly administered *in vivo*, where it is expressed to produce the encoded product. This can

be accomplished by any of numerous methods known in the art, e.g., by constructing them as part of an appropriate nucleic acid expression vector and administering it so that they become intracellular, e.g., by infection using defective or attenuated retrovirals or other viral vectors (see U.S. Patent No. 4,980,286), or by direct injection of naked DNA, or by use of microparticle bombardment (e.g., a gene gun; Biolistic, Dupont), or coating with lipids or cell-surface receptors or transfecting agents, encapsulation in liposomes, microparticles, or microcapsules, or by administering them in linkage to a peptide which is known to enter the nucleus, by administering it in linkage to a ligand subject to receptor-mediated endocytosis (see, e.g., Wu and Wu, J. Biol. Chem. 262:4429-4432 (1987)) (which can be used to target cell types specifically expressing the receptors), etc. In another embodiment, nucleic acid-ligand complexes can be formed in which the ligand comprises a fusogenic viral peptide to disrupt endosomes, allowing the nucleic acid to avoid lysosomal degradation. In yet another embodiment, the nucleic acid can be targeted *in vivo* for cell specific uptake and expression, by targeting a specific receptor (see, e.g., PCT Publications WO 92/06180; WO 92/22635; WO92/20316; WO93/14188, WO 93/20221). Alternatively, the nucleic acid can be introduced intracellularly and incorporated within host cell DNA for expression, by homologous recombination (Koller and Smithies, Proc. Natl. Acad. Sci. USA 86:8932-8935 (1989); Zijlstra et al., Nature 342:435-438 (1989)).

[0312] In a specific embodiment, viral vectors that contains nucleic acid sequences encoding an antibody of the invention are used. For example, a retroviral vector can be used (see Miller et al., Meth. Enzymol. 217:581-599 (1993)). These retroviral vectors contain the components necessary for the correct packaging of the viral genome and integration into the host cell DNA. The nucleic acid sequences encoding the antibody to be used in gene therapy are cloned into one or more vectors, which facilitates delivery of the gene into a patient. More detail about retroviral vectors can be found in Boesen et al., Biotherapy 6:291-302 (1994), which describes the use of a retroviral vector to deliver the *mdr1* gene to hematopoietic stem cells in order to make the stem cells more resistant to chemotherapy. Other references illustrating the use of retroviral vectors in gene therapy are: Clowes et al., J. Clin. Invest. 93:644-651 (1994); Kiem et al., Blood 83:1467-1473 (1994); Salmons and Gunzberg, Human

Gene Therapy 4:129-141 (1993); and Grossman and Wilson, Curr. Opin. in Genetics and Devel. 3:110-114 (1993).

[0313] Adenoviruses are other viral vectors that can be used in gene therapy. Adenoviruses are especially attractive vehicles for delivering genes to respiratory epithelia. Adenoviruses naturally infect respiratory epithelia where they cause a mild disease. Other targets for adenovirus-based delivery systems are liver, the central nervous system, endothelial cells, and muscle. Adenoviruses have the advantage of being capable of infecting non-dividing cells. Kozarsky and Wilson, Current Opinion in Genetics and Development 3:499-503 (1993) present a review of adenovirus-based gene therapy. Bout et al., Human Gene Therapy 5:3-10 (1994) demonstrated the use of adenovirus vectors to transfer genes to the respiratory epithelia of rhesus monkeys. Other instances of the use of adenoviruses in gene therapy can be found in Rosenfeld et al., Science 252:431-434 (1991); Rosenfeld et al., Cell 68:143-155 (1992); Mastrangeli et al., J. Clin. Invest. 91:225-234 (1993); PCT Publication WO94/12649; and Wang, et al., Gene Therapy 2:775-783 (1995). In a preferred embodiment, adenovirus vectors are used.

[0314] Adeno-associated virus (AAV) has also been proposed for use in gene therapy (Walsh et al., Proc. Soc. Exp. Biol. Med. 204:289-300 (1993); U.S. Patent No. 5,436,146).

[0315] Another approach to gene therapy involves transferring a gene to cells in tissue culture by such methods as electroporation, lipofection, calcium phosphate mediated transfection, or viral infection. Usually, the method of transfer includes the transfer of a selectable marker to the cells. The cells are then placed under selection to isolate those cells that have taken up and are expressing the transferred gene. Those cells are then delivered to a patient.

[0316] In this embodiment, the nucleic acid is introduced into a cell prior to administration *in vivo* of the resulting recombinant cell. Such introduction can be carried out by any method known in the art, including but not limited to transfection, electroporation, microinjection, infection with a viral or bacteriophage vector containing the nucleic acid sequences, cell fusion, chromosome-mediated gene transfer, microcell-mediated gene transfer, spheroplast fusion, etc. Numerous techniques are known in the art for the introduction of foreign genes into cells (see,

e.g., Loeffler and Behr, Meth. Enzymol. 217:599-618 (1993); Cohen et al., Meth. Enzymol. 217:618-644 (1993); Cline, Pharmac. Ther. 29:69-92m (1985) and may be used in accordance with the present invention, provided that the necessary developmental and physiological functions of the recipient cells are not disrupted. The technique should provide for the stable transfer of the nucleic acid to the cell, so that the nucleic acid is expressible by the cell and preferably heritable and expressible by its cell progeny.

[0317] The resulting recombinant cells can be delivered to a patient by various methods known in the art. Recombinant blood cells (e.g., hematopoietic stem or progenitor cells) are preferably administered intravenously. The amount of cells envisioned for use depends on the desired effect, patient state, etc., and can be determined by one skilled in the art.

[0318] Cells into which a nucleic acid can be introduced for purposes of gene therapy encompass any desired, available cell type, and include but are not limited to epithelial cells, endothelial cells, keratinocytes, fibroblasts, muscle cells, hepatocytes; blood cells such as T lymphocytes, B lymphocytes, monocytes, macrophages, neutrophils, eosinophils, megakaryocytes, granulocytes; various stem or progenitor cells, in particular hematopoietic stem or progenitor cells, e.g., as obtained from bone marrow, umbilical cord blood, peripheral blood, fetal liver, etc.

[0319] In a preferred embodiment, the cell used for gene therapy is autologous to the patient.

[0320] In an embodiment in which recombinant cells are used in gene therapy, nucleic acid sequences encoding an antibody are introduced into the cells such that they are expressible by the cells or their progeny, and the recombinant cells are then administered *in vivo* for therapeutic effect. In a specific embodiment, stem or progenitor cells are used. Any stem and/or progenitor cells which can be isolated and maintained *in vitro* can potentially be used in accordance with this embodiment of the present invention (see e.g. PCT Publication WO 94/08598; Stemple and Anderson, Cell 71:973-985 (1992); Rheinwald, Meth. Cell Bio. 21A:229 (1980); and Pittelkow and Scott, Mayo Clinic Proc. 61:771 (1986)).

[0321] In a specific embodiment, the nucleic acid to be introduced for purposes of gene therapy comprises an inducible promoter operably linked to the coding region,

such that expression of the nucleic acid is controllable by the presence or absence of an appropriate inducer of transcription.

Demonstration of Therapeutic or Prophylactic Activity

[0322] The compounds or pharmaceutical compositions of the invention are preferably tested *in vitro*, and then *in vivo* for the desired therapeutic or prophylactic activity, prior to use in humans. For example, *in vitro* assays to demonstrate the therapeutic or prophylactic utility of a compound or pharmaceutical composition include, the effect of a compound on a cell line or a patient tissue sample. The effect of the compound or composition on the cell line and/or tissue sample can be determined utilizing techniques known to those of skill in the art including, but not limited to, rosette formation assays and cell lysis assays. In accordance with the invention, *in vitro* assays which can be used to determine whether administration of a specific compound is indicated, include *in vitro* cell culture assays in which a patient tissue sample is grown in culture, and exposed to or otherwise administered a compound, and the effect of such compound upon the tissue sample is observed.

Therapeutic/Prophylactic Administration and Composition

[0323] The invention provides methods of treatment, inhibition and prophylaxis by administration to a subject of an effective amount of a compound or pharmaceutical composition of the invention, preferably a polypeptide or antibody of the invention. In a preferred embodiment, the compound is substantially purified (e.g., substantially free from substances that limit its effect or produce undesired side-effects). The subject is preferably an animal, including but not limited to animals such as cows, pigs, horses, chickens, cats, dogs, etc., and is preferably a mammal, and most preferably human.

[0324] Formulations and methods of administration that can be employed when the compound comprises a nucleic acid or an immunoglobulin are described above; additional appropriate formulations and routes of administration can be selected from among those described herein below.

[0325] Various delivery systems are known and can be used to administer a compound of the invention, e.g., encapsulation in liposomes, microparticles,

microcapsules, recombinant cells capable of expressing the compound, receptor-mediated endocytosis (see, e.g., Wu and Wu, J. Biol. Chem. 262:4429-4432 (1987)), construction of a nucleic acid as part of a retroviral or other vector, etc. Methods of introduction include but are not limited to intradermal, intramuscular, intraperitoneal, intravenous, subcutaneous, intranasal, epidural, and oral routes. The compounds or compositions may be administered by any convenient route, for example by infusion or bolus injection, by absorption through epithelial or mucocutaneous linings (e.g., oral mucosa, rectal and intestinal mucosa, etc.) and may be administered together with other biologically active agents. Administration can be systemic or local. In addition, it may be desirable to introduce the pharmaceutical compounds or compositions of the invention into the central nervous system by any suitable route, including intraventricular and intrathecal injection; intraventricular injection may be facilitated by an intraventricular catheter, for example, attached to a reservoir, such as an Ommaya reservoir. Pulmonary administration can also be employed, e.g., by use of an inhaler or nebulizer, and formulation with an aerosolizing agent.

[0326] In a specific embodiment, it may be desirable to administer the pharmaceutical compounds or compositions of the invention locally to the area in need of treatment; this may be achieved by, for example, and not by way of limitation, local infusion during surgery, topical application, e.g., in conjunction with a wound dressing after surgery, by injection, by means of a catheter, by means of a suppository, or by means of an implant, said implant being of a porous, non-porous, or gelatinous material, including membranes, such as sialastic membranes, or fibers. Preferably, when administering a protein, including an antibody, of the invention, care must be taken to use materials to which the protein does not absorb.

[0327] In another embodiment, the compound or composition can be delivered in a vesicle, in particular a liposome (see Langer, Science 249:1527-1533 (1990); Treat et al., in Liposomes in the Therapy of Infectious Disease and Cancer, Lopez-Berestein and Fidler (eds.), Liss, New York, pp. 353- 365 (1989); Lopez-Berestein, *ibid.*, pp. 317-327; see generally *ibid.*)

[0328] In yet another embodiment, the compound or composition can be delivered in a controlled release system. In one embodiment, a pump may be used (see Langer, *supra*; Sefton, CRC Crit. Ref. Biomed. Eng. 14:201 (1987); Buchwald et al., Surgery

88:507 (1980); Saudek et al., N. Engl. J. Med. 321:574 (1989)). In another embodiment, polymeric materials can be used (see Medical Applications of Controlled Release, Langer and Wise (eds.), CRC Pres., Boca Raton, Florida (1974); Controlled Drug Bioavailability, Drug Product Design and Performance, Smolen and Ball (eds.), Wiley, New York (1984); Ranger and Peppas, J., Macromol. Sci. Rev. Macromol. Chem. 23:61 (1983); see also Levy et al., Science 228:190 (1985); During et al., Ann. Neurol. 25:351 (1989); Howard et al., J. Neurosurg. 71:105 (1989)). In yet another embodiment, a controlled release system can be placed in proximity of the therapeutic target, e.g., the brain, thus requiring only a fraction of the systemic dose (see, e.g., Goodson, in Medical Applications of Controlled Release, *supra*, vol. 2, pp. 115-138 (1984)).

[0329] Other controlled release systems are discussed in the review by Langer (Science 249:1527-1533 (1990)).

[0330] In a specific embodiment where the compound of the invention is a nucleic acid encoding a protein, the nucleic acid can be administered *in vivo* to promote expression of its encoded protein, by constructing it as part of an appropriate nucleic acid expression vector and administering it so that it becomes intracellular, e.g., by use of a retroviral vector (see U.S. Patent No. 4,980,286), or by direct injection, or by use of microparticle bombardment (e.g., a gene gun; Biolistic, Dupont), or coating with lipids or cell-surface receptors or transfecting agents, or by administering it in linkage to a homeobox-like peptide which is known to enter the nucleus (see e.g., Joliot et al., Proc. Natl. Acad. Sci. USA 88:1864-1868 (1991)), etc. Alternatively, a nucleic acid can be introduced intracellularly and incorporated within host cell DNA for expression, by homologous recombination.

[0331] The present invention also provides pharmaceutical compositions. Such compositions comprise a therapeutically effective amount of a compound, and a pharmaceutically acceptable carrier. In a specific embodiment, the term "pharmaceutically acceptable" means approved by a regulatory agency of the Federal or a state government or listed in the U.S. Pharmacopeia or other generally recognized pharmacopeia for use in animals, and more particularly in humans. The term "carrier" refers to a diluent, adjuvant, excipient, or vehicle with which the therapeutic is administered. Such pharmaceutical carriers can be sterile liquids, such as water and

oils, including those of petroleum, animal, vegetable or synthetic origin, such as peanut oil, soybean oil, mineral oil, sesame oil and the like. Water is a preferred carrier when the pharmaceutical composition is administered intravenously. Saline solutions and aqueous dextrose and glycerol solutions can also be employed as liquid carriers, particularly for injectable solutions. Suitable pharmaceutical excipients include starch, glucose, lactose, sucrose, gelatin, malt, rice, flour, chalk, silica gel, sodium stearate, glycerol monostearate, talc, sodium chloride, dried skim milk, glycerol, propylene, glycol, water, ethanol and the like. The composition, if desired, can also contain minor amounts of wetting or emulsifying agents, or pH buffering agents. These compositions can take the form of solutions, suspensions, emulsion, tablets, pills, capsules, powders, sustained-release formulations and the like. The composition can be formulated as a suppository, with traditional binders and carriers such as triglycerides. Oral formulation can include standard carriers such as pharmaceutical grades of mannitol, lactose, starch, magnesium stearate, sodium saccharine, cellulose, magnesium carbonate, etc. Examples of suitable pharmaceutical carriers are described in "Remington's Pharmaceutical Sciences" by E.W. Martin. Such compositions will contain a therapeutically effective amount of the compound, preferably in purified form, together with a suitable amount of carrier so as to provide the form for proper administration to the patient. The formulation should suit the mode of administration.

[0332] In a preferred embodiment, the composition is formulated in accordance with routine procedures as a pharmaceutical composition adapted for intravenous administration to human beings. Typically, compositions for intravenous administration are solutions in sterile isotonic aqueous buffer. Where necessary, the composition may also include a solubilizing agent and a local anesthetic such as lignocaine to ease pain at the site of the injection. Generally, the ingredients are supplied either separately or mixed together in unit dosage form, for example, as a dry lyophilized powder or water free concentrate in a hermetically sealed container such as an ampoule or sachette indicating the quantity of active agent. Where the composition is to be administered by infusion, it can be dispensed with an infusion bottle containing sterile pharmaceutical grade water or saline. Where the composition

is administered by injection, an ampoule of sterile water for injection or saline can be provided so that the ingredients may be mixed prior to administration.

[0333] The compounds of the invention can be formulated as neutral or salt forms. Pharmaceutically acceptable salts include those formed with anions such as those derived from hydrochloric, phosphoric, acetic, oxalic, tartaric acids, etc., and those formed with cations such as those derived from sodium, potassium, ammonium, calcium, ferric hydroxides, isopropylamine, triethylamine, 2-ethylamino ethanol, histidine, procaine, etc.

[0334] The amount of the compound of the invention which will be effective in the treatment, inhibition and prevention of a disease or disorder associated with aberrant expression and/or activity of a polypeptide of the invention can be determined by standard clinical techniques. In addition, *in vitro* assays may optionally be employed to help identify optimal dosage ranges. The precise dose to be employed in the formulation will also depend on the route of administration, and the seriousness of the disease or disorder, and should be decided according to the judgment of the practitioner and each patient's circumstances. Effective doses may be extrapolated from dose-response curves derived from *in vitro* or animal model test systems.

[0335] For antibodies, the dosage administered to a patient is typically 0.1 mg/kg to 100 mg/kg of the patient's body weight. Preferably, the dosage administered to a patient is between 0.1 mg/kg and 20 mg/kg of the patient's body weight, more preferably 1 mg/kg to 10 mg/kg of the patient's body weight. Generally, human antibodies have a longer half-life within the human body than antibodies from other species due to the immune response to the foreign polypeptides. Thus, lower dosages of human antibodies and less frequent administration is often possible. Further, the dosage and frequency of administration of antibodies of the invention may be reduced by enhancing uptake and tissue penetration (e.g., into the brain) of the antibodies by modifications such as, for example, lipidation.

[0336] The invention also provides a pharmaceutical pack or kit comprising one or more containers filled with one or more of the ingredients of the pharmaceutical compositions of the invention. Optionally associated with such container(s) can be a notice in the form prescribed by a governmental agency regulating the manufacture,

use or sale of pharmaceuticals or biological products, which notice reflects approval by the agency of manufacture, use or sale for human administration.

Diagnosis and Imaging

[0337] Labeled antibodies, and derivatives and analogs thereof, which specifically bind to a polypeptide of interest can be used for diagnostic purposes to detect, diagnose, or monitor diseases, disorders, and/or conditions associated with the aberrant expression and/or activity of a polypeptide of the invention. The invention provides for the detection of aberrant expression of a polypeptide of interest, comprising (a) assaying the expression of the polypeptide of interest in cells or body fluid of an individual using one or more antibodies specific to the polypeptide interest and (b) comparing the level of gene expression with a standard gene expression level, whereby an increase or decrease in the assayed polypeptide gene expression level compared to the standard expression level is indicative of aberrant expression.

[0338] The invention provides a diagnostic assay for diagnosing a reproductive system disorder, comprising (a) assaying the expression of the polypeptide of interest in cells or body fluid of an individual using one or more antibodies specific to the polypeptide interest and (b) comparing the level of gene expression with a standard gene expression level, whereby an increase or decrease in the assayed polypeptide gene expression level compared to the standard expression level is indicative of a particular disorder. With respect to cancer, the presence of a relatively high amount of transcript in biopsied tissue from an individual may indicate a predisposition for the development of the disease, or may provide a means for detecting the disease prior to the appearance of actual clinical symptoms. A more definitive diagnosis of this type may allow health professionals to employ preventative measures or aggressive treatment earlier thereby preventing the development or further progression of the cancer.

[0339] Antibodies of the invention can be used to assay protein levels in a biological sample using classical immunohistological methods known to those of skill in the art (e.g., see Jalkanen et al., J. Cell. Biol. 101:976-985 (1985); Jalkanen et al., J. Cell Biol. 105:3087-3096 (1987)). Other antibody-based methods useful for detecting protein gene expression include immunoassays, such as the enzyme linked

immunosorbent assay (ELISA) and the radioimmunoassay (RIA). Suitable antibody assay labels are known in the art and include enzyme labels, such as, glucose oxidase; radioisotopes, such as iodine (125I, 121I), carbon (14C), sulfur (35S), tritium (3H), indium (112In), and technetium (99Tc); luminescent labels, such as luminol; and fluorescent labels, such as fluorescein and rhodamine, and biotin.

[0340] One facet of the invention is the detection and diagnosis of a disease or disorder associated with aberrant expression of a polypeptide of interest in an animal, preferably a mammal and most preferably a human. A preferred embodiment of the invention is the detection and diagnosis of a disease or disorder of the reproductive system associated with aberrant expression of a reproductive system antigen in an animal, preferably a mammal and most preferably a human. In one embodiment, diagnosis comprises: a) administering (for example, parenterally, subcutaneously, or intraperitoneally) to a subject an effective amount of a labeled molecule which specifically binds to the polypeptide of interest; b) waiting for a time interval following the administering for permitting the labeled molecule to preferentially concentrate at sites in the subject where the polypeptide is expressed (and for unbound labeled molecule to be cleared to background level); c) determining background level; and d) detecting the labeled molecule in the subject, such that detection of labeled molecule above the background level indicates that the subject has a particular disease or disorder associated with aberrant expression of the polypeptide of interest. Background level can be determined by various methods including, comparing the amount of labeled molecule detected to a standard value previously determined for a particular system.

[0341] It will be understood in the art that the size of the subject and the imaging system used will determine the quantity of imaging moiety needed to produce diagnostic images. In the case of a radioisotope moiety, for a human subject, the quantity of radioactivity injected will normally range from about 5 to 20 millicuries of 99mTc. The labeled antibody or antibody fragment will then preferentially accumulate at the location of cells which contain the specific protein. *In vivo* tumor imaging is described in S.W. Burchiel et al., "Immunopharmacokinetics of Radiolabeled Antibodies and Their Fragments." (Chapter 13 in Tumor Imaging: The

Radiochemical Detection of Cancer, S.W. Burchiel and B. A. Rhodes, eds., Masson Publishing Inc. (1982)).

[0342] Depending on several variables, including the type of label used and the mode of administration, the time interval following the administration for permitting the labeled molecule to preferentially concentrate at sites in the subject and for unbound labeled molecule to be cleared to background level is 6 to 48 hours or 6 to 24 hours or 6 to 12 hours. In another embodiment the time interval following administration is 5 to 20 days or 5 to 10 days.

[0343] In an embodiment, monitoring of the disease or disorder is carried out by repeating the method for diagnosing the disease or disorder, for example, one month after initial diagnosis, six months after initial diagnosis, one year after initial diagnosis, etc.

[0344] Presence of the labeled molecule can be detected in the patient using methods known in the art for *in vivo* scanning. These methods depend upon the type of label used. Skilled artisans will be able to determine the appropriate method for detecting a particular label. Methods and devices that may be used in the diagnostic methods of the invention include, but are not limited to, computed tomography (CT), whole body scan such as position emission tomography (PET), magnetic resonance imaging (MRI), and sonography.

[0345] In a specific embodiment, the molecule is labeled with a radioisotope and is detected in the patient using a radiation responsive surgical instrument (Thurston et al., U.S. Patent No. 5,441,050). In another embodiment, the molecule is labeled with a fluorescent compound and is detected in the patient using a fluorescence responsive scanning instrument. In another embodiment, the molecule is labeled with a positron emitting metal and is detected in the patient using positron emission-tomography. In yet another embodiment, the molecule is labeled with a paramagnetic label and is detected in a patient using magnetic resonance imaging (MRI).

Kits

[0346] The present invention provides kits that can be used in the above methods. In one embodiment, a kit comprises an antibody of the invention, preferably a purified antibody, in one or more containers. In a specific embodiment, the kits of the present

invention contain a substantially isolated polypeptide comprising an epitope which is specifically immunoreactive with an antibody included in the kit. Preferably, the kits of the present invention further comprise a control antibody which does not react with the polypeptide of interest. In another specific embodiment, the kits of the present invention contain a means for detecting the binding of an antibody to a polypeptide of interest (e.g., the antibody may be conjugated to a detectable substrate such as a fluorescent compound, an enzymatic substrate, a radioactive compound or a luminescent compound, or a second antibody which recognizes the first antibody may be conjugated to a detectable substrate).

[0347] In another specific embodiment of the present invention, the kit is a diagnostic kit for use in screening serum containing antibodies specific against proliferative and/or cancerous polynucleotides and polypeptides. Such a kit may include a control antibody that does not react with the polypeptide of interest. Such a kit may include a substantially isolated polypeptide antigen comprising an epitope which is specifically immunoreactive with at least one anti-polypeptide antigen antibody. Further, such a kit includes means for detecting the binding of said antibody to the antigen (e.g., the antibody may be conjugated to a fluorescent compound such as fluorescein or rhodamine which can be detected by flow cytometry). In specific embodiments, the kit may include a recombinantly produced or chemically synthesized polypeptide antigen. The polypeptide antigen of the kit may also be attached to a solid support.

[0348] In a more specific embodiment the detecting means of the above-described kit includes a solid support to which said polypeptide antigen is attached. Such a kit may also include a non-attached reporter-labeled anti-human antibody. In this embodiment, binding of the antibody to the polypeptide antigen can be detected by binding of the said reporter-labeled antibody.

[0349] In an additional embodiment, the invention includes a diagnostic kit for use in screening serum containing antigens of the polypeptide of the invention. The diagnostic kit includes a substantially isolated antibody specifically immunoreactive with polypeptide or polynucleotide antigens, and means for detecting the binding of the polynucleotide or polypeptide antigen to the antibody. In one embodiment, the antibody is attached to a solid support. In a specific embodiment, the antibody may be

a monoclonal antibody. The detecting means of the kit may include a second, labeled monoclonal antibody. Alternatively, or in addition, the detecting means may include a labeled, competing antigen.

[0350] In one diagnostic configuration, test serum is reacted with a solid phase reagent having a surface-bound antigen obtained by the methods of the present invention. After binding with specific antigen antibody to the reagent and removing unbound serum components by washing, the reagent is reacted with reporter-labeled anti-human antibody to bind reporter to the reagent in proportion to the amount of bound anti-antigen antibody on the solid support. The reagent is again washed to remove unbound labeled antibody, and the amount of reporter associated with the reagent is determined. Typically, the reporter is an enzyme which is detected by incubating the solid phase in the presence of a suitable fluorometric, luminescent or colorimetric substrate (Sigma, St. Louis, MO).

[0351] The solid surface reagent in the above assay is prepared by known techniques for attaching protein material to solid support material, such as polymeric beads, dip sticks, 96-well plate or filter material. These attachment methods generally include non-specific adsorption of the protein to the support or covalent attachment of the protein, typically through a free amine group, to a chemically reactive group on the solid support, such as an activated carboxyl, hydroxyl, or aldehyde group. Alternatively, streptavidin coated plates can be used in conjunction with biotinylated antigen(s).

[0352] Thus, the invention provides an assay system or kit for carrying out this diagnostic method. The kit generally includes a support with surface-bound recombinant antigens, and a reporter-labeled anti-human antibody for detecting surface-bound anti-antigen antibody.

Uses of the Polynucleotides

[0353] Each of the polynucleotides identified herein can be used in numerous ways as reagents. The following description should be considered exemplary and utilizes known techniques.

[0354] The polynucleotides of the present invention are useful for chromosome identification. There exists an ongoing need to identify new chromosome markers, since few chromosome marking reagents, based on actual sequence data (repeat polymorphisms), are presently available. Each sequence is specifically targeted to and can hybridize with a particular location on an individual human chromosome, thus each polynucleotide of the present invention can routinely be used as a chromosome marker using techniques known in the art. Table 1A, column 8 provides the chromosome location of some of the polynucleotides of the invention.

[0355] Briefly, sequences can be mapped to chromosomes by preparing PCR primers (preferably at least 15 bp (e.g., 15-25 bp) from the sequences shown in SEQ ID NO:X. Primers can optionally be selected using computer analysis so that primers do not span more than one predicted exon in the genomic DNA. These primers are then used for PCR screening of somatic cell hybrids containing individual human chromosomes. Only those hybrids containing the human gene corresponding to SEQ ID NO:X will yield an amplified fragment.

[0356] Similarly, somatic hybrids provide a rapid method of PCR mapping the polynucleotides to particular chromosomes. Three or more clones can be assigned per day using a single thermal cycler. Moreover, sublocalization of the polynucleotides can be achieved with panels of specific chromosome fragments. Other gene mapping strategies that can be used include in situ hybridization, prescreening with labeled flow-sorted chromosomes, preselection by hybridization to construct chromosome specific-cDNA libraries, and computer mapping techniques (See, e.g., Shuler, Trends Biotechnol 16:456-459 (1998) which is hereby incorporated by reference in its entirety).

[0357] Precise chromosomal location of the polynucleotides can also be achieved using fluorescence in situ hybridization (FISH) of a metaphase chromosomal spread. This technique uses polynucleotides as short as 500 or 600 bases; however, polynucleotides 2,000-4,000 bp are preferred. For a review of this technique, see Verma et al., "Human Chromosomes: a Manual of Basic Techniques," Pergamon Press, New York (1988).

[0358] For chromosome mapping, the polynucleotides can be used individually (to mark a single chromosome or a single site on that chromosome) or in panels (for marking multiple sites and/or multiple chromosomes).

[0359] Thus, the present invention also provides a method for chromosomal localization which involves (a) preparing PCR primers from the polynucleotide sequences in Table 1A and/or Table 2 and SEQ ID NO:X and (b) screening somatic cell hybrids containing individual chromosomes.

[0360] The polynucleotides of the present invention would likewise be useful for radiation hybrid mapping, HAPPY mapping, and long range restriction mapping. For a review of these techniques and others known in the art, see, e.g. Dear, "Genome Mapping: A Practical Approach," IRL Press at Oxford University Press, London (1997); Aydin, J. Mol. Med. 77:691-694 (1999); Hacia et al., Mol. Psychiatry 3:483-492 (1998); Herrick et al., Chromosome Res. 7:409-423 (1999); Hamilton et al., Methods Cell Biol. 62:265-280 (2000); and/or Ott, J. Hered. 90:68-70 (1999), each of which is hereby incorporated by reference in its entirety.

[0361] Once a polynucleotide has been mapped to a precise chromosomal location, the physical position of the polynucleotide can be used in linkage analysis. Linkage analysis establishes coinheritance between a chromosomal location and presentation of a particular disease. (Disease mapping data are found, for example, in V. McKusick, Mendelian Inheritance in Man (available on line through Johns Hopkins University Welch Medical Library).) Column 9 of Table 1A provides an OMIM reference identification number of diseases associated with the cytologic band disclosed in column 8 of Table 1A, as determined using techniques described herein and by reference to Table 5. Assuming 1 megabase mapping resolution and one gene per 20 kb, a cDNA precisely localized to a chromosomal region associated with the disease could be one of 50-500 potential causative genes.

[0362] Thus, once coinheritance is established, differences in a polynucleotide of the invention and the corresponding gene between affected and unaffected individuals can be examined. First, visible structural alterations in the chromosomes, such as deletions or translocations, are examined in chromosome spreads or by PCR. If no structural alterations exist, the presence of point mutations are ascertained. Mutations observed in some or all affected individuals, but not in normal individuals, indicates

that mutations may cause the disease. However, complete sequencing of the polypeptide and the corresponding gene from several normal individuals is required to distinguish the mutation from a polymorphism. If a new polymorphism is identified, this polymorphic polypeptide can be used for further linkage analysis.

[0363] Furthermore, increased or decreased expression of the gene in affected individuals as compared to unaffected individuals can be assessed using the polynucleotides of the invention. Any of these alterations (altered expression, chromosomal rearrangement, or mutation) can be used as a diagnostic or prognostic marker. Diagnostic and prognostic methods, kits and reagents encompassed by the present invention are briefly described below and more thoroughly elsewhere herein (see e.g., the sections labeled "Antibodies", "Diagnostic Assays", and "Methods for Detecting Reproductive System Disease, Including Cancer").

[0364] Thus, the invention also provides a diagnostic method useful during diagnosis of a disorder, involving measuring the expression level of polynucleotides of the present invention in cells or body fluid from an individual and comparing the measured gene expression level with a standard level of polynucleotide expression level, whereby an increase or decrease in the gene expression level compared to the standard is indicative of a disorder. Additional non-limiting examples of diagnostic methods encompassed by the present invention are more thoroughly described elsewhere herein (see, e.g., Example 12).

[0365] In still another embodiment, the invention includes a kit for analyzing samples for the presence of proliferative and/or cancerous polynucleotides derived from a test subject, as further described herein. In a general embodiment, the kit includes at least one polynucleotide probe containing a nucleotide sequence that will specifically hybridize with a polynucleotide of the invention and a suitable container. In a specific embodiment, the kit includes two polynucleotide probes defining an internal region of the polynucleotide of the invention, where each probe has one strand containing a 31' mer-end internal to the region. In a further embodiment, the probes may be useful as primers for polymerase chain reaction amplification.

[0366] Where a diagnosis of a related disorder, including, for example, diagnosis of a tumor, has already been made according to conventional methods, the present invention is useful as a prognostic indicator, whereby patients exhibiting enhanced or

depressed polynucleotide of the invention expression will experience a worse clinical outcome relative to patients expressing the gene at a level nearer the standard level.

[0367] By "measuring the expression level of polynucleotides of the invention" is intended qualitatively or quantitatively measuring or estimating the level of the polypeptide of the invention or the level of the mRNA encoding the polypeptide of the invention in a first biological sample either directly (e.g., by determining or estimating absolute protein level or mRNA level) or relatively (e.g., by comparing to the polypeptide level or mRNA level in a second biological sample). Preferably, the polypeptide level or mRNA level in the first biological sample is measured or estimated and compared to a standard polypeptide level or mRNA level, the standard being taken from a second biological sample obtained from an individual not having the related disorder or being determined by averaging levels from a population of individuals not having a related disorder. As will be appreciated in the art, once a standard polypeptide level or mRNA level is known, it can be used repeatedly as a standard for comparison.

[0368] By "biological sample" is intended any biological sample obtained from an individual, body fluid, cell line, tissue culture, or other source which contains polypeptide of the present invention or the corresponding mRNA. As indicated, biological samples include body fluids (such as semen, lymph, vaginal pool, sera, plasma, urine, synovial fluid and spinal fluid) which contain the polypeptide of the present invention, and tissue sources found to express the polypeptide of the present invention. Methods for obtaining tissue biopsies and body fluids from mammals are well known in the art. Where the biological sample is to include mRNA, a tissue biopsy is the preferred source.

[0369] The method(s) provided above may preferably be applied in a diagnostic method and/or kits in which polynucleotides and/or polypeptides of the invention are attached to a solid support. In one exemplary method, the support may be a "gene chip" or a "biological chip" as described in U.S. Patents 5,837,832, 5,874,219, and 5,856,174. Further, such a gene chip with polynucleotides of the invention attached may be used to identify polymorphisms between the isolated polynucleotide sequences of the invention, with polynucleotides isolated from a test subject. The knowledge of such polymorphisms (i.e., their location, as well as, their existence) would be

beneficial in identifying disease loci for many disorders, such as for example, in neural disorders, immune system disorders, muscular disorders, reproductive disorders, gastrointestinal disorders, pulmonary disorders, digestive disorders, cardiovascular disorders, renal disorders, proliferative disorders, and/or cancerous diseases and conditions. Such a method is described in U.S. Patents 5,858,659 and 5,856,104. The U.S. Patents referenced *supra* are hereby incorporated by reference in their entirety herein.

[0370] The present invention encompasses polynucleotides of the present invention that are chemically synthesized, or reproduced as peptide nucleic acids (PNA), or according to other methods known in the art. The use of PNAs would serve as the preferred form if the polynucleotides of the invention are incorporated onto a solid support, or gene chip. For the purposes of the present invention, a peptide nucleic acid (PNA) is a polyamide type of DNA analog and the monomeric units for adenine, guanine, thymine and cytosine are available commercially (Perceptive Biosystems). Certain components of DNA, such as phosphorus, phosphorus oxides, or deoxyribose derivatives, are not present in PNAs. As disclosed by Nielsen et al., Science 254:1497 (1991); and Egholm et al., Nature 365:666 (1993), PNAs bind specifically and tightly to complementary DNA strands and are not degraded by nucleases. In fact, PNA binds more strongly to DNA than DNA itself does. This is probably because there is no electrostatic repulsion between the two strands, and also the polyamide backbone is more flexible. Because of this, PNA/DNA duplexes bind under a wider range of stringency conditions than DNA/DNA duplexes, making it easier to perform multiplex hybridization. Smaller probes can be used than with DNA due to the strong binding. In addition, it is more likely that single base mismatches can be determined with PNA/DNA hybridization because a single mismatch in a PNA/DNA 15-mer lowers the melting point ($T_{sub.m}$) by 8°-20° C, vs. 4°-16° C for the DNA/DNA 15-mer duplex. Also, the absence of charge groups in PNA means that hybridization can be done at low ionic strengths and reduce possible interference by salt during the analysis.

[0371] The compounds of the present invention have uses which include, but are not limited to, detecting cancer in mammals. In particular the invention is useful during diagnosis of pathological cell proliferative neoplasias which include, but are not limited to: acute myelogenous leukemias including acute monocytic leukemia,

acute myeloblastic leukemia, acute promyelocytic leukemia, acute myelomonocytic leukemia, acute erythroleukemia, acute megakaryocytic leukemia, and acute undifferentiated leukemia, etc.; and chronic myelogenous leukemias including chronic myelomonocytic leukemia, chronic granulocytic leukemia, etc. Preferred mammals include monkeys, apes, cats, dogs, cows, pigs, horses, rabbits and humans. Particularly preferred are humans.

[0372] The compounds of the present invention have preferred uses which include, but are not limited to, detecting reproductive system cancers in mammals. In particular the invention is useful during diagnosis of pathological cell proliferative neoplasias which include, but are not limited to: testicular cancers (including, for example, teratocarcinoma, embryonal cell carcinoma, yolk sac tumors, Leydig cell tumors, and as listed below in the section entitled "Reproductive System Disorders"), prostate cancers (e.g., adenocarcinomas, transitional cell carcinomas, ductal carcinomas, squamous cell carcinomas, and as listed below in the section entitled "Reproductive System Disorders"), penile cancers (such as squamous cell carcinoma, verrucous carcinoma, penile urethral carcinoma, and as listed below in the section entitled "Reproductive System Disorders"), cancers of the vagina and vulva (including, for example, basal cell carcinoma, melanomas, cancer of Bartholin's gland, and as listed below in the section entitled "Reproductive System Disorders"), uterine cancers (such as adenocarcinomas, leiomyosarcomas, and as listed below in the section entitled "Reproductive System Disorders"), ovarian cancers (e.g., Sertoli-Leydig tumors, endometrioid carcinoma of the ovary, ovarian papillary serous adenocarcinoma, ovarian Krukenberg tumors, and as listed below in the section entitled "Reproductive System Disorders"), and cancers of the cervix (including, for example, squamous metaplasia, columnar cell neoplasia, squamous cell carcinoma, and as listed below in the section entitled "Reproductive System Disorders"). Preferred mammals include monkeys, apes, cats, dogs, cows, pigs, horses, rabbits and humans. Particularly preferred are humans.

[0373] Pathological cell proliferative disorders are often associated with inappropriate activation of proto-oncogenes. (Gelman, E. P. et al., "The Etiology of Acute Leukemia: Molecular Genetics and Viral Oncology," in Neoplastic Diseases of the Blood, Vol 1., Wiernik, P. H. et al. eds., 161-182 (1985)). Neoplasias are now

believed to result from the qualitative alteration of a normal cellular gene product, or from the quantitative modification of gene expression by insertion into the chromosome of a viral sequence, by chromosomal translocation of a gene to a more actively transcribed region, or by some other mechanism. (Gelman et al., *supra*) It is likely that mutated or altered expression of specific genes is involved in the pathogenesis of some leukemias, among other tissues and cell types. (Gelman et al., *supra*) Indeed, the human counterparts of the oncogenes involved in some animal neoplasias have been amplified or translocated in some cases of human leukemia and carcinoma. (Gelman et al., *supra*)

[0374] For example, c-myc expression is highly amplified in the non-lymphocytic leukemia cell line HL-60. When HL-60 cells are chemically induced to stop proliferation, the level of c-myc is found to be downregulated. (International Publication Number WO 91/15580). However, it has been shown that exposure of HL-60 cells to a DNA construct that is complementary to the 5' end of c-myc or c-myb blocks translation of the corresponding mRNAs which downregulates expression of the c-myc or c-myb proteins and causes arrest of cell proliferation and differentiation of the treated cells. (International Publication Number WO 91/15580; Wickstrom et al., Proc. Natl. Acad. Sci. 85:1028 (1988); Anfossi et al., Proc. Natl. Acad. Sci. 86:3379 (1989)). However, the skilled artisan would appreciate the present invention's usefulness is not be limited to treatment, prevention, diagnosis and/or prognosis, of proliferative disorders of cells and tissues of hematopoietic origin, in light of the numerous cells and cell types of varying origins which are known to exhibit proliferative phenotypes. In preferred embodiments, the compounds and/or methods of the invention are used to treat, prevent, diagnose, and/or prognose, proliferative disorders of reproductive system cells and tissues.

[0375] In addition to the foregoing, a polynucleotide of the present invention can be used to control gene expression through triple helix formation or through antisense DNA or RNA. Antisense techniques are discussed, for example, in Okano, J. Neurochem. 56: 560 (1991); "Oligodeoxynucleotides as Antisense Inhibitors of Gene Expression, CRC Press, Boca Raton, FL (1988). Triple helix formation is discussed in, for instance Lee et al., Nucleic Acids Research 6: 3073 (1979); Cooney et al., Science 241: 456 (1988); and Dervan et al., Science 251: 1360 (1991). Both methods rely on

binding of the polynucleotide to a complementary DNA or RNA. For these techniques, preferred polynucleotides are usually oligonucleotides 20 to 40 bases in length and complementary to either the region of the gene involved in transcription (triple helix - see Lee et al., Nucl. Acids Res. 6:3073 (1979); Cooney et al., Science 241:456 (1988); and Dervan et al., Science 251:1360 (1991)) or to the mRNA itself (antisense - Okano, J. Neurochem. 56:560 (1991); Oligodeoxy-nucleotides as Antisense Inhibitors of Gene Expression, CRC Press, Boca Raton, FL (1988).) Triple helix formation optimally results in a shut-off of RNA transcription from DNA, while antisense RNA hybridization blocks translation of an mRNA molecule into polypeptide. The oligonucleotide described above can also be delivered to cells such that the antisense RNA or DNA may be expressed *in vivo* to inhibit production of polypeptide of the present invention antigens. Both techniques are effective in model systems, and the information disclosed herein can be used to design antisense or triple helix polynucleotides in an effort to treat disease, and in particular, for the treatment of proliferative diseases and/or conditions. Non-limiting antisense and triple helix methods encompassed by the present invention are more thoroughly described elsewhere herein (see, e.g., the section labeled "Antisense and Ribozyme (Antagonists)").

[0376] Polynucleotides of the present invention are also useful in gene therapy. One goal of gene therapy is to insert a normal gene into an organism having a defective gene, in an effort to correct the genetic defect. The polynucleotides disclosed in the present invention offer a means of targeting such genetic defects in a highly accurate manner. Another goal is to insert a new gene that was not present in the host genome, thereby producing a new trait in the host cell. Additional non-limiting examples of gene therapy methods encompassed by the present invention are more thoroughly described elsewhere herein (see, e.g., the sections labeled "Gene Therapy Methods" and Examples 16, 17 and 18).

[0377] The polynucleotides are also useful for identifying individuals from minute biological samples. The United States military, for example, is considering the use of restriction fragment length polymorphism (RFLP) for identification of its personnel. In this technique, an individual's genomic DNA is digested with one or more restriction enzymes, and probed on a Southern blot to yield unique bands for

identifying personnel. This method does not suffer from the current limitations of "Dog Tags" which can be lost, switched, or stolen, making positive identification difficult. The polynucleotides of the present invention can be used as additional DNA markers for RFLP.

[0378] The polynucleotides of the present invention can also be used as an alternative to RFLP, by determining the actual base-by-base DNA sequence of selected portions of an individual's genome. These sequences can be used to prepare PCR primers for amplifying and isolating such selected DNA, which can then be sequenced. Using this technique, individuals can be identified because each individual will have a unique set of DNA sequences. Once an unique ID database is established for an individual, positive identification of that individual, living or dead, can be made from extremely small tissue samples.

[0379] Forensic biology also benefits from using DNA-based identification techniques as disclosed herein. DNA sequences taken from very small biological samples such as tissues, e.g., hair or skin, or body fluids, e.g., blood, saliva, semen, synovial fluid, amniotic fluid, breast milk, lymph, pulmonary sputum or surfactant, urine, fecal matter, etc., can be amplified using PCR. In one prior art technique, gene sequences amplified from polymorphic loci, such as DQa class II HLA gene, are used in forensic biology to identify individuals. (Erich, H., PCR Technology, Freeman and Co. (1992).) Once these specific polymorphic loci are amplified, they are digested with one or more restriction enzymes, yielding an identifying set of bands on a Southern blot probed with DNA corresponding to the DQa class II HLA gene. Similarly, polynucleotides of the present invention can be used as polymorphic markers for forensic purposes.

[0380] There is also a need for reagents capable of identifying the source of a particular tissue. Such need arises, for example, in forensics when presented with tissue of unknown origin. Appropriate reagents can comprise, for example, DNA probes or primers prepared from the sequences of the present invention, specific to tissues, including but not limited to, those sequences referred to in Table 1A. Panels of such reagents can identify tissue by species and/or by organ type. In a similar fashion, these reagents can be used to screen tissue cultures for contamination. Additional non-limiting examples of such uses are further described herein.

[0381] Because reproductive system antigens are found expressed in reproductive system tissues, the polynucleotides of the present invention are also useful as hybridization probes for differential identification of the tissue(s) or cell type(s) present in a biological sample. Similarly, polypeptides and antibodies directed to polypeptides of the present invention are useful to provide immunological probes for differential identification of the tissue(s) (e.g., immunohistochemistry assays) or cell type(s) (e.g., immunocytochemistry assays). In a specific embodiment, the polynucleotides of the present invention are also useful as hybridization probes for differential identification of reproductive system tissue(s) or cell type(s) present in a biological sample. Similarly, polypeptides and antibodies directed to polypeptides of the present invention are useful to provide immunological probes for differential identification of reproductive system tissue(s) (e.g., immunohistochemistry assays) or cell type(s) (e.g., immunocytochemistry assays). In addition, for a number of disorders of the above tissues or cells, significantly higher or lower levels of gene expression of the polynucleotides/polypeptides of the present invention may be detected in certain tissues (e.g., tissues expressing polypeptides and/or polynucleotides of the present invention, for example, normal reproductive system tissues or diseased reproductive system tissues, and/or those tissues/cells corresponding to the library source relating to a polynucleotide sequence of the invention as disclosed in column 7 of Table 1A, and/or cancerous and/or wounded tissues) or bodily fluids (e.g., semen, lymph, vaginal pool, serum, plasma, urine, synovial fluid or spinal fluid) taken from an individual having such a disorder, relative to a "standard" gene expression level, i.e., the expression level in healthy tissue from an individual not having the disorder.

[0382] Thus, the invention provides a diagnostic method of a disorder, which involves: (a) assaying gene expression level in cells or body fluid of an individual; (b) comparing the gene expression level with a standard gene expression level, whereby an increase or decrease in the assayed gene expression level compared to the standard expression level is indicative of a disorder.

[0383] In the very least, the polynucleotides of the present invention can be used as molecular weight markers on Southern gels, as diagnostic probes for the presence of a specific mRNA in a particular cell type, as a probe to "subtract-out" known sequences in the process of discovering novel polynucleotides, for selecting and

making oligomers for attachment to a "gene chip" or other support, to raise anti-DNA antibodies using DNA immunization techniques, and as an antigen to elicit an immune response.

Uses of the Polypeptides

[0384] Each of the polypeptides identified herein can be used in numerous ways.

The following description should be considered exemplary and utilizes known techniques.

[0385] Polypeptides and antibodies directed to polypeptides of the present invention are useful to provide immunological probes for differential identification of the tissue(s) (e.g., immunohistochemistry assays such as, for example, ABC immunoperoxidase (Hsu et al., J. Histochem. Cytochem. 29:577-580 (1981)) or cell type(s) (e.g., immunocytochemistry assays).

[0386] Antibodies can be used to assay levels of polypeptides encoded by polynucleotides of the invention in a biological sample using classical immunohistological methods known to those of skill in the art (see, e.g., Jalkanen, et al., J. Cell. Biol. 101:976-985 (1985); Jalkanen, et al., J. Cell. Biol. 105:3087-3096 (1987)). Other antibody-based methods useful for detecting protein gene expression include immunoassays, such as the enzyme linked immunosorbent assay (ELISA) and the radioimmunoassay (RIA). Suitable antibody assay labels are known in the art and include enzyme labels, such as, glucose oxidase; radioisotopes, such as iodine (^{131}I , ^{125}I , ^{123}I , ^{121}I), carbon (^{14}C), sulfur (^{35}S), tritium (^3H), indium ($^{115\text{m}}\text{In}$, $^{113\text{m}}\text{In}$, ^{112}In , ^{111}In), and technetium (^{99}Tc , $^{99\text{m}}\text{Tc}$), thallium (^{201}Tl), gallium (^{68}Ga , ^{67}Ga), palladium (^{103}Pd), molybdenum (^{99}Mo), xenon (^{133}Xe), fluorine (^{18}F), ^{153}Sm , ^{177}Lu , ^{159}Gd , ^{149}Pm , ^{140}La , ^{175}Yb , ^{166}Ho , ^{90}Y , ^{47}Sc , ^{186}Re , ^{188}Re , ^{142}Pr , ^{105}Rh , ^{97}Ru ; luminescent labels, such as luminol; and fluorescent labels, such as fluorescein and rhodamine, and biotin.

[0387] In addition to assaying levels of polypeptide of the present invention in a biological sample, proteins can also be detected *in vivo* by imaging. Antibody labels or markers for *in vivo* imaging of protein include those detectable by X-radiography, NMR or ESR. For X-radiography, suitable labels include radioisotopes such as barium or cesium, which emit detectable radiation but are not overtly harmful to the subject. Suitable markers for NMR and ESR include those with a detectable

characteristic spin, such as deuterium, which may be incorporated into the antibody by labeling of nutrients for the relevant hybridoma.

[0388] A reproductive system antigen-specific antibody or antibody fragment which has been labeled with an appropriate detectable imaging moiety, such as a radioisotope (for example, ^{131}I , ^{112}In , $^{99\text{m}}\text{Tc}$, (^{131}I , ^{125}I , ^{123}I , ^{121}I), carbon (^{14}C), sulfur (^{35}S), tritium (^3H), indium ($^{115\text{m}}\text{In}$, $^{113\text{m}}\text{In}$, ^{112}In , ^{111}In), and technetium (^{99}Tc , $^{99\text{m}}\text{Tc}$), thallium (^{201}Tl), gallium (^{68}Ga , ^{67}Ga), palladium (^{103}Pd), molybdenum (^{99}Mo), xenon (^{133}Xe), fluorine (^{18}F , ^{153}Sm , ^{177}Lu , ^{159}Gd , ^{149}Pm , ^{140}La , ^{175}Yb , ^{166}Ho , ^{90}Y , ^{47}Sc , ^{186}Re , ^{188}Re , ^{142}Pr , ^{105}Rh , ^{97}Ru), a radio-opaque substance, or a material detectable by nuclear magnetic resonance, is introduced (for example, parenterally, subcutaneously or intraperitoneally) into the mammal to be examined for reproductive system disorder. It will be understood in the art that the size of the subject and the imaging system used will determine the quantity of imaging moiety needed to produce diagnostic images. In the case of a radioisotope moiety, for a human subject, the quantity of radioactivity injected will normally range from about 5 to 20 millicuries of $^{99\text{m}}\text{Tc}$. The labeled antibody or antibody fragment will then preferentially accumulate at the location of cells which express the polypeptide encoded by a polynucleotide of the invention. *In vivo* tumor imaging is described in S.W. Burchiel et al., "Immunopharmacokinetics of Radiolabeled Antibodies and Their Fragments" (Chapter 13 in *Tumor Imaging: The Radiochemical Detection of Cancer*, S.W. Burchiel and B. A. Rhodes, eds., Masson Publishing Inc. (1982)).

[0389] In one embodiment, the invention provides a method for the specific delivery of compositions of the invention to cells by administering polypeptides of the invention (e.g., polypeptides encoded by polynucleotides of the invention and/or antibodies) that are associated with heterologous polypeptides or nucleic acids. In one example, the invention provides a method for delivering a therapeutic protein into the targeted cell. In another example, the invention provides a method for delivering a single stranded nucleic acid (e.g., antisense or ribozymes) or double stranded nucleic acid (e.g., DNA that can integrate into the cell's genome or replicate episomally and that can be transcribed) into the targeted cell.

[0390] In another embodiment, the invention provides a method for the specific destruction of cells (e.g., the destruction of tumor cells) by administering polypeptides of the invention in association with toxins or cytotoxic prodrugs.

[0391] In a preferred embodiment, the invention provides a method for the specific destruction of reproductive system cells (e.g., aberrant reproductive system cells, neoplasms of the reproductive system) by administering polypeptides of the invention (e.g., polypeptides encoded by polynucleotides of the invention and/or antibodies) in association with toxins or cytotoxic prodrugs. In another preferred embodiment the invention provides a method for the specific destruction of tissues/cells corresponding to the library source relating to a polynucleotide sequence of the invention as disclosed in column 7 of Table 1A by administering polypeptides of the invention in association with toxins or cytotoxic prodrugs.

[0392] By "toxin" is meant one or more compounds that bind and activate endogenous cytotoxic effector systems, radioisotopes, holotoxins, modified toxins, catalytic subunits of toxins, or any molecules or enzymes not normally present in or on the surface of a cell that under defined conditions cause the cell's death. Toxins that may be used according to the methods of the invention include, but are not limited to, radioisotopes known in the art, compounds such as, for example, antibodies (or complement fixing containing portions thereof) that bind an inherent or induced endogenous cytotoxic effector system, thymidine kinase, endonuclease, RNase, alpha toxin, ricin, abrin, *Pseudomonas* exotoxin A, diphtheria toxin, saporin, momordin, gelonin, pokeweed antiviral protein, alpha-sarcin and cholera toxin. "Toxin" also includes a cytostatic or cytocidal agent, a therapeutic agent or a radioactive metal ion, e.g., alpha-emitters such as, for example, ^{213}Bi , or other radioisotopes such as, for example, ^{103}Pd , ^{133}Xe , ^{131}I , ^{111}In , ^{68}Ge , ^{57}Co , ^{65}Zn , ^{85}Sr , ^{32}P , ^{35}S , ^{90}Y , ^{153}Sm , ^{153}Gd , ^{169}Yb , ^{51}Cr , ^{54}Mn , ^{75}Se , ^{113}Sn , $^{90}\text{Yttrium}$, ^{117}Tin , $^{186}\text{Rhenium}$, $^{166}\text{Holmium}$, and $^{188}\text{Rhenium}$; luminescent labels, such as luminol; and fluorescent labels, such as fluorescein and rhodamine, and biotin.

[0393] In a specific embodiment, the invention provides a method for the specific destruction of cells (e.g., the destruction of tumor cells) by administering polypeptides of the invention or antibodies of the invention in association with the radioisotope ^{90}Y . In another specific embodiment, the invention provides a method for the specific

destruction of cells (e.g., the destruction of tumor cells) by administering polypeptides of the invention or antibodies of the invention in association with the radioisotope ^{111}In . In a further specific embodiment, the invention provides a method for the specific destruction of cells (e.g., the destruction of tumor cells) by administering polypeptides of the invention or antibodies of the invention in association with the radioisotope ^{131}I .

[0394] Techniques known in the art may be applied to label polypeptides of the invention (including antibodies). Such techniques include, but are not limited to, the use of bifunctional conjugating agents (see e.g., U.S. Patent Nos. 5,756,065; 5,714,631; 5,696,239; 5,652,361; 5,505,931; 5,489,425; 5,435,990; 5,428,139; 5,342,604; 5,274,119; 4,994,560; and 5,808,003; the contents of each of which are hereby incorporated by reference in its entirety).

[0395] Thus, the invention provides a diagnostic method of a disorder, which involves (a) assaying the expression level of a polypeptide of the present invention in cells or body fluid of an individual; and (b) comparing the assayed polypeptide expression level with a standard polypeptide expression level, whereby an increase or decrease in the assayed polypeptide expression level compared to the standard expression level is indicative of a disorder. With respect to cancer, the presence of a relatively high amount of transcript in biopsied tissue from an individual may indicate a predisposition for the development of the disease, or may provide a means for detecting the disease prior to the appearance of actual clinical symptoms. A more definitive diagnosis of this type may allow health professionals to employ preventative measures or aggressive treatment earlier thereby preventing the development or further progression of the cancer.

[0396] Moreover, polypeptides of the present invention can be used to treat or prevent diseases or conditions of the reproductive system such as, for example, reproductive system injury and trauma, infections, neoplastic disorders, congenital defects, and diseases or disorders which result in infertility, complications with pregnancy, labor, or parturition, postpartum difficulties, and as listed below in the section entitled "Reproductive System Disorders". In preferred embodiments, polynucleotides expressed in a particular tissue type (see, e.g., Table 1A, column 7) are used to diagnose, detect, prevent, treat and/or prognose disorders associated with

the tissue type. For example, patients can be administered a polypeptide of the present invention in an effort to replace absent or decreased levels of the polypeptide (e.g., insulin), to supplement absent or decreased levels of a different polypeptide (e.g., hemoglobin S for hemoglobin B, SOD, catalase, DNA repair proteins), to inhibit the activity of a polypeptide (e.g., an oncogene or tumor suppressor), to activate the activity of a polypeptide (e.g., by binding to a receptor), to reduce the activity of a membrane bound receptor by competing with it for free ligand (e.g., soluble TNF receptors used in reducing inflammation), or to bring about a desired response (e.g., blood vessel growth inhibition, enhancement of the immune response to proliferative cells or tissues).

[0397] Similarly, antibodies directed to a polypeptide of the present invention can also be used to treat disease (as described *supra*, and elsewhere herein). For example, administration of an antibody directed to a polypeptide of the present invention can bind, and/or neutralize the polypeptide, and/or reduce overproduction of the polypeptide. Similarly, administration of an antibody can activate the polypeptide, such as by binding to a polypeptide bound to a membrane (receptor).

[0398] At the very least, the polypeptides of the present invention can be used as molecular weight markers on SDS-PAGE gels or on molecular sieve gel filtration columns using methods well known to those of skill in the art. Polypeptides can also be used to raise antibodies, which in turn are used to measure protein expression from a recombinant cell, as a way of assessing transformation of the host cell. Moreover, the polypeptides of the present invention can be used to test the biological activities described herein.

Diagnostic Assays

[0399] The compounds of the present invention are useful for diagnosis, treatment, prevention and/or prognosis of various reproductive system related disorders in mammals, preferably humans. Such disorders include, but are not limited to, reproductive system injury and trauma, infections, neoplastic disorders, congenital defects, and diseases or disorders which result in infertility, complications with pregnancy, labor, or parturition, postpartum difficulties, and as listed below in the section entitled "Reproductive System Disorders". In preferred embodiments,

polynucleotides expressed in a particular tissue type (see, e.g., Table 1A, column 7) are used to diagnose, detect, prevent, treat and/or prognose disorders associated with the tissue type.

[0400] Reproductive system antigens are expressed in reproductive system. For a number of reproductive system-related disorders, substantially altered (increased or decreased) levels of reproductive system antigen gene expression can be detected in reproductive system tissue or other cells or bodily fluids (e.g., sera, plasma, urine, semen, synovial fluid or spinal fluid) taken from an individual having such a disorder, relative to a "standard" reproductive system antigen gene expression level, that is, the reproductive system antigen expression level in reproductive system tissues or bodily fluids from an individual not having the reproductive system disorder. Thus, the invention provides a diagnostic method useful during diagnosis of a reproductive system disorder, which involves measuring the expression level of the gene encoding the reproductive system associated polypeptide in reproductive system tissue or other cells or body fluid from an individual and comparing the measured gene expression level with a standard reproductive system antigens gene expression level, whereby an increase or decrease in the gene expression level(s) compared to the standard is indicative of an reproductive system disorder.

[0401] In specific embodiments, the invention provides a diagnostic method useful during diagnosis of a disorder of a normal or diseased tissue/cell source corresponding to column 7 of Table 1A, which involves measuring the expression level of the coding sequence of a polynucleotide sequence associated with this tissue/cell source as disclosed in Table 1A in the tissue/cell source or other cells or body fluid from an individual and comparing the expression level of the coding sequence with a standard expression level of the coding sequence of a polynucleotide sequence, whereby an increase or decrease in the gene expression level(s) compared to the standard is indicative of a disorder of a normal or diseased tissue/cell source corresponding to column 7 of Table 1A.

[0402] In particular, it is believed that certain tissues in mammals with cancer of cells or tissue of the reproductive system express significantly enhanced or reduced levels of normal or altered reproductive system antigen expression and mRNA encoding the reproductive system associated polypeptide when compared to a

corresponding "standard" level. Further, it is believed that enhanced or depressed levels of the reproductive system associated polypeptide can be detected in certain body fluids (e.g., sera, plasma, urine, and spinal fluid) or cells or tissue from mammals with such a cancer when compared to sera from mammals of the same species not having the cancer.

[0403] For example, as disclosed herein, reproductive system associated polypeptides of the invention are expressed in tissues of the reproductive system. Accordingly, polynucleotides of the invention (e.g., polynucleotide sequences complementary to all or a portion of a reproductive system antigen mRNA nucleotide sequence of SEQ ID NO:X, nucleotide sequence encoding SEQ ID NO:Y, nucleotide sequence encoding a polypeptide encoded by SEQ ID NO:X and/or a nucleotide sequence delineated by columns 8 and 9 of Table 2) and antibodies (and antibody fragments) directed against the polypeptides of the invention may be used to quantitate or qualitate concentrations of cells of the reproductive system expressing reproductive system antigens, preferably on their cell surfaces. These polynucleotides and antibodies additionally have diagnostic applications in detecting abnormalities in the level of reproductive system antigens gene expression, or abnormalities in the structure and/or temporal, tissue, cellular, or subcellular location of reproductive system antigens. These diagnostic assays may be performed *in vivo* or *in vitro*, such as, for example, on blood samples, biopsy tissue or autopsy tissue. In specific embodiments, polynucleotides and antibodies of the invention are used to quantitate or qualitate tissues/cells corresponding to the library source disclosed in column 7 of Table 1A expressing the corresponding reproductive system sequence disclosed in the same row of Table 1A, preferably on their cell surface.

[0404] Thus, the invention provides a diagnostic method useful during diagnosis of a reproductive system disorder, including cancers, which involves measuring the expression level of the gene encoding the reproductive system antigen polypeptide in tissues of the reproductive system or other cells or body fluid from an individual and comparing the measured gene expression level with a standard reproductive system antigen gene expression level, whereby an increase or decrease in the gene expression level compared to the standard is indicative of a reproductive system disorder. In specific embodiments, polynucleotides and antibodies of the invention are used to

quantitate or qualitate tissues/cells corresponding to the library source disclosed in column 7 of Table 1A expressing the corresponding reproductive system sequence disclosed in the same row of Table 1A, preferably on their cell surface.

[0405] Where a diagnosis of a disorder in the reproductive system, including diagnosis of a tumor, has already been made according to conventional methods, the present invention is useful as a prognostic indicator, whereby patients exhibiting enhanced or depressed reproductive system antigen gene expression will experience a worse clinical outcome relative to patients expressing the gene at a level nearer the standard level.

[0406] By "assaying the expression level of the gene encoding the reproductive system associated polypeptide" is intended qualitatively or quantitatively measuring or estimating the level of the reproductive system antigen polypeptide or the level of the mRNA encoding the reproductive system antigen polypeptide in a first biological sample either directly (e.g., by determining or estimating absolute protein level or mRNA level) or relatively (e.g., by comparing to the reproductive system associated polypeptide level or mRNA level in a second biological sample). Preferably, the reproductive system antigen polypeptide expression level or mRNA level in the first biological sample is measured or estimated and compared to a standard reproductive system antigen polypeptide level or mRNA level, the standard being taken from a second biological sample obtained from an individual not having the disorder or being determined by averaging levels from a population of individuals not having a disorder of the reproductive system. As will be appreciated in the art, once a standard reproductive system antigen polypeptide level or mRNA level is known, it can be used repeatedly as a standard for comparison.

[0407] By "biological sample" is intended any biological sample obtained from an individual, cell line, tissue culture, or other source containing reproductive system antigen polypeptides (including portions thereof) or mRNA. As indicated, biological samples include body fluids (such as sera, plasma, urine, synovial fluid and spinal fluid) which contain cells expressing reproductive system antigen polypeptides, tissues of the reproductive system, and other tissue sources found to express the full length or fragments thereof of a reproductive system antigen. Methods for obtaining tissue biopsies and body fluids from mammals are well known in the art. Where the

biological sample is to include mRNA, a tissue biopsy is the preferred source.

[0408] Total cellular RNA can be isolated from a biological sample using any suitable technique such as the single-step guanidinium-thiocyanate-phenol-chloroform method described in Chomczynski and Sacchi, *Anal. Biochem.* 162:156-159 (1987). Levels of mRNA encoding the reproductive system antigen polypeptides are then assayed using any appropriate method. These include Northern blot analysis, S1 nuclease mapping, the polymerase chain reaction (PCR), reverse transcription in combination with the polymerase chain reaction (RT-PCR), and reverse transcription in combination with the ligase chain reaction (RT-LCR).

[0409] The present invention also relates to diagnostic assays such as quantitative and diagnostic assays for detecting levels of reproductive system antigen polypeptides, in a biological sample (e.g., cells and tissues), including determination of normal and abnormal levels of polypeptides. Thus, for instance, a diagnostic assay in accordance with the invention for detecting over-expression of reproductive system antigens compared to normal control tissue samples may be used to detect the presence of tumors. Assay techniques that can be used to determine levels of a polypeptide, such as a reproductive system antigen polypeptide of the present invention in a sample derived from a host are well-known to those of skill in the art. Such assay methods include radioimmunoassays, competitive-binding assays, Western Blot analysis and ELISA assays. Assaying reproductive system antigen polypeptide levels in a biological sample can occur using any art-known method.

[0410] Assaying reproductive system antigen polypeptide levels in a biological sample can occur using antibody-based techniques. For example, reproductive system antigen polypeptide expression in tissues can be studied with classical immunohistological methods (Jalkanen et al., *J. Cell. Biol.* 101:976-985 (1985); Jalkanen, M., et al., *J. Cell. Biol.* 105:3087-3096 (1987)). Other antibody-based methods useful for detecting reproductive system antigen polypeptide gene expression include immunoassays, such as the enzyme linked immunosorbent assay (ELISA) and the radioimmunoassay (RIA). Suitable antibody assay labels are known in the art and include enzyme labels, such as, glucose oxidase, and radioisotopes, such as iodine (^{125}I , ^{121}I), carbon (^{14}C), sulfur (^{35}S), tritium (^3H), indium (^{112}In), and technetium ($^{99\text{m}}\text{Tc}$), and fluorescent labels, such as fluorescein and rhodamine, and biotin.

- [0411] The tissue or cell type to be analyzed will generally include those which are known, or suspected, to express the reproductive system related antigen gene (such as, for example, cells of the reproductive system or cancers of the reproductive system). The protein isolation methods employed herein may, for example, be such as those described in Harlow and Lane (Harlow, E. and Lane, D., 1988, "Antibodies: A Laboratory Manual", Cold Spring Harbor Laboratory Press, Cold Spring Harbor, New York), which is incorporated herein by reference in its entirety. The isolated cells can be derived from cell culture or from a patient. The analysis of cells taken from culture may be a necessary step in the assessment of cells that could be used as part of a cell-based gene therapy technique or, alternatively, to test the effect of compounds on the expression of the reproductive system related antigen gene.
- [0412] For example, antibodies, or fragments of antibodies, such as those described herein, may be used to quantitatively or qualitatively detect the presence of reproductive system related antigen gene products or conserved variants or peptide fragments thereof. This can be accomplished, for example, by immunofluorescence techniques employing a fluorescently labeled antibody coupled with light microscopic, flow cytometric, or fluorimetric detection.
- [0413] In a preferred embodiment, antibodies, or fragments of antibodies directed to any one or all of the predicted epitope domains of the reproductive system related antigen polypeptides (Shown in Table 1A, column 6) may be used to quantitatively or qualitatively detect the presence of reproductive system related antigen gene products or conserved variants or peptide fragments thereof. This can be accomplished, for example, by immunofluorescence techniques employing a fluorescently labeled antibody coupled with light microscopic, flow cytometric, or fluorimetric detection.
- [0414] In an additional preferred embodiment, antibodies, or fragments of antibodies directed to a conformational epitope of a reproductive system related antigen may be used to quantitatively or qualitatively detect the presence of reproductive system related antigen gene products or conserved variants or peptide fragments thereof. This can be accomplished, for example, by immunofluorescence techniques employing a fluorescently labeled antibody coupled with light microscopic, flow cytometric, or fluorimetric detection.
- [0415] The antibodies (or fragments thereof), and/or reproductive system related

antigen polypeptides of the present invention may, additionally, be employed histologically, as in immunofluorescence, immunoelectron microscopy or non-immunological assays, for in situ detection of reproductive system related antigen gene products or conserved variants or peptide fragments thereof. In situ detection may be accomplished by removing a histological specimen from a patient, and applying thereto a labeled antibody or reproductive system related antigen polypeptide of the present invention. The antibody (or fragment thereof) or reproductive system related antigen polypeptide is preferably applied by overlaying the labeled antibody (or fragment) onto a biological sample. Through the use of such a procedure, it is possible to determine not only the presence of the reproductive system related antigen gene product, or conserved variants or peptide fragments, or reproductive system related antigen polypeptide binding, but also its distribution in the examined tissue. Using the present invention, those of ordinary skill will readily perceive that any of a wide variety of histological methods (such as staining procedures) can be modified in order to achieve such in situ detection.

[0416] Immunoassays and non-immunoassays for reproductive system related antigen gene products or conserved variants or peptide fragments thereof will typically comprise incubating a sample, such as a biological fluid, a tissue extract, freshly harvested cells, or lysates of cells which have been incubated in cell culture, in the presence of a detectably labeled antibody capable of binding reproductive system related antigen gene products or conserved variants or peptide fragments thereof, and detecting the bound antibody by any of a number of techniques well-known in the art.

[0417] The biological sample may be brought in contact with and immobilized onto a solid phase support or carrier such as nitrocellulose, or other solid support which is capable of immobilizing cells, cell particles or soluble proteins. The support may then be washed with suitable buffers followed by treatment with the detectably labeled anti-reproductive system related antigen antibody or detectable reproductive system related antigen polypeptide. The solid phase support may then be washed with the buffer a second time to remove unbound antibody or polypeptide. Optionally the antibody is subsequently labeled. The amount of bound label on solid support may then be detected by conventional means.

[0418] By "solid phase support or carrier" is intended any support capable of

binding an antigen or an antibody. Well-known supports or carriers include glass, polystyrene, polypropylene, polyethylene, dextran, nylon, amylases, natural and modified celluloses, polyacrylamides, gabbros, and magnetite. The nature of the carrier can be either soluble to some extent or insoluble for the purposes of the present invention. The support material may have virtually any possible structural configuration so long as the coupled molecule is capable of binding to an antigen or antibody. Thus, the support configuration may be spherical, as in a bead, or cylindrical, as in the inside surface of a test tube, or the external surface of a rod. Alternatively, the surface may be flat such as a sheet, test strip, etc. Preferred supports include polystyrene beads. Those skilled in the art will know many other suitable carriers for binding antibody or antigen, or will be able to ascertain the same by use of routine experimentation.

[0419] The binding activity of a given lot of anti- reproductive system related antigen antibody or reproductive system related antigen polypeptide may be determined according to well known methods. Those skilled in the art will be able to determine operative and optimal assay conditions for each determination by employing routine experimentation.

[0420] In addition to assaying reproductive system related antigen polypeptide levels or polynucleotide levels in a biological sample obtained from an individual, reproductive system related antigen polypeptide or polynucleotide can also be detected *in vivo* by imaging. For example, in one embodiment of the invention, reproductive system related antigen polypeptide and/or anti- reproductive system related antigen antibodies are used to image reproductive system diseased cells, such as neoplasms. In another embodiment, reproductive system related antigen polynucleotides of the invention (e.g., polynucleotides complementary to all or a portion of reproductive system related antigen mRNA) and/or anti- reproductive system related antigen antibodies (e.g., antibodies directed to any one or a combination of the epitopes of reproductive system related antigens, antibodies directed to a conformational epitope of reproductive system related antigens, antibodies directed to the full length polypeptide expressed on the cell surface of a mammalian cell) are used to image diseased or neoplastic cells of the reproductive system.

[0421] Antibody labels or markers for *in vivo* imaging of reproductive system

related antigen polypeptides include those detectable by X-radiography, NMR, MRI, CAT-scans or ESR. For X-radiography, suitable labels include radioisotopes such as barium or cesium, which emit detectable radiation but are not overtly harmful to the subject. Suitable markers for NMR and ESR include those with a detectable characteristic spin, such as deuterium, which may be incorporated into the antibody by labeling of nutrients for the relevant hybridoma. Where *in vivo* imaging is used to detect enhanced levels of reproductive system related antigen polypeptides for diagnosis in humans, it may be preferable to use human antibodies or "humanized" chimeric monoclonal antibodies. Such antibodies can be produced using techniques described herein or otherwise known in the art. For example methods for producing chimeric antibodies are known in the art. See, for review, Morrison, Science 229:1202 (1985); Oi et al., BioTechniques 4:214 (1986); Cabilly et al., U.S. Patent No. 4,816,567; Taniguchi et al., EP 171496; Morrison et al., EP 173494; Neuberger et al., WO 8601533; Robinson et al., WO 8702671; Boulianne et al., Nature 312:643 (1984); Neuberger et al., Nature 314:268 (1985).

[0422] Additionally, any reproductive system related antigen polypeptides whose presence can be detected, can be administered. For example, reproductive system related antigen polypeptides labeled with a radio-opaque or other appropriate compound can be administered and visualized *in vivo*, as discussed, above for labeled antibodies. Further such reproductive system related antigen polypeptides can be utilized for *in vitro* diagnostic procedures.

[0423] A reproductive system related antigen polypeptide-specific antibody or antibody fragment which has been labeled with an appropriate detectable imaging moiety, such as a radioisotope (for example, ^{131}I , ^{112}In , $^{99\text{m}}\text{Tc}$), a radio-opaque substance, or a material detectable by nuclear magnetic resonance, is introduced (for example, parenterally, subcutaneously or intraperitoneally) into the mammal to be examined for a disorder of the reproductive system. It will be understood in the art that the size of the subject and the imaging system used will determine the quantity of imaging moiety needed to produce diagnostic images. In the case of a radioisotope moiety, for a human subject, the quantity of radioactivity injected will normally range from about 5 to 20 millicuries of $^{99\text{m}}\text{Tc}$. The labeled antibody or antibody fragment will then preferentially accumulate at the location of cells which contain reproductive

system related antigen protein. *In vivo* tumor imaging is described in S.W. Burchiel et al., "Immunopharmacokinetics of Radiolabeled Antibodies and Their Fragments" (Chapter 13 in *Tumor Imaging: The Radiochemical Detection of Cancer*, S.W. Burchiel and B. A. Rhodes, eds., Masson Publishing Inc. (1982)).

[0424] With respect to antibodies, one of the ways in which the anti-reproductive system related antigen antibody can be detectably labeled is by linking the same to an enzyme and using the linked product in an enzyme immunoassay (EIA) (Voller, A., "The Enzyme Linked Immunosorbent Assay (ELISA)", 1978, Diagnostic Horizons 2:1-7, Microbiological Associates Quarterly Publication, Walkersville, MD); Voller et al., J. Clin. Pathol. 31:507-520 (1978); Butler, J.E., Meth. Enzymol. 73:482-523 (1981); Maggio, E. (ed.), 1980, Enzyme Immunoassay, CRC Press, Boca Raton, FL.; Ishikawa, E. et al., (eds.), 1981, Enzyme Immunoassay, Kaku Shoin, Tokyo). The enzyme which is bound to the antibody will react with an appropriate substrate, preferably a chromogenic substrate, in such a manner as to produce a chemical moiety which can be detected, for example, by spectrophotometric, fluorimetric or by visual means. Enzymes which can be used to detectably label the antibody include, but are not limited to, malate dehydrogenase, staphylococcal nuclease, delta-5-steroid isomerase, yeast alcohol dehydrogenase, alpha-glycerophosphate dehydrogenase, triose phosphate isomerase, horseradish peroxidase, alkaline phosphatase, asparaginase, glucose oxidase, beta-galactosidase, ribonuclease, urease, catalase, glucose-6-phosphate dehydrogenase, glucoamylase and acetylcholinesterase. Additionally, the detection can be accomplished by colorimetric methods which employ a chromogenic substrate for the enzyme. Detection may also be accomplished by visual comparison of the extent of enzymatic reaction of a substrate in comparison with similarly prepared standards.

[0425] Detection may also be accomplished using any of a variety of other immunoassays. For example, by radioactively labeling the antibodies or antibody fragments, it is possible to detect reproductive system related antigens through the use of a radioimmunoassay (RIA) (see, for example, Weintraub, B., Principles of Radioimmunoassays, Seventh Training Course on Radioligand Assay Techniques, The Endocrine Society, March, 1986, which is incorporated by reference herein). The radioactive isotope can be detected by means including, but not limited to, a gamma

counter, a scintillation counter, or autoradiography.

[0426] It is also possible to label the antibody with a fluorescent compound. When the fluorescently labeled antibody is exposed to light of the proper wave length, its presence can then be detected due to fluorescence. Among the most commonly used fluorescent labeling compounds are fluorescein isothiocyanate, rhodamine, phycoerythrin, phycocyanin, allophycocyanin, ophthaldehyde and fluorescamine.

[0427] The antibody can also be detectably labeled using fluorescence emitting metals such as ^{152}Eu , or others of the lanthanide series. These metals can be attached to the antibody using such metal chelating groups as diethylenetriaminepentacetic acid (DTPA) or ethylenediaminetetraacetic acid (EDTA).

[0428] The antibody also can be detectably labeled by coupling it to a chemiluminescent compound. The presence of the chemiluminescent-tagged antibody is then determined by detecting the presence of luminescence that arises during the course of a chemical reaction. Examples of particularly useful chemiluminescent labeling compounds are luminol, isoluminol, theromatic acridinium ester, imidazole, acridinium salt and oxalate ester.

[0429] Likewise, a bioluminescent compound may be used to label the antibody of the present invention. Bioluminescence is a type of chemiluminescence found in biological systems in, which a catalytic protein increases the efficiency of the chemiluminescent reaction. The presence of a bioluminescent protein is determined by detecting the presence of luminescence. Important bioluminescent compounds for purposes of labeling are luciferin, luciferase and aequorin.

Methods for Detecting Diseases of the Reproductive System, Including Cancer

[0430] In general, a disease of the reproductive system or cancer may be detected in a patient based on the presence of one or more reproductive system related antigen proteins of the invention and/or polynucleotides encoding such proteins in a biological sample (for example, blood, sera, urine, and/or tumor biopsies) obtained from the patient. In other words, such proteins and/or polynucleotides may be used as markers to indicate the presence or absence of a reproductive system disease or disorder, including cancer. Cancers that may be diagnosed, and/or prognosed using the compositions of the invention include but are not limited to, cancers of the

reproductive system. In addition, such proteins and/or polynucleotides may be useful for the detection of other diseases and cancers, including cancers of tissues/cells corresponding to the library source disclosed in column 7 of Table 1A expressing the corresponding reproductive system related sequence disclosed in the same row of Table 1A. The binding agents provided herein generally permit detection of the level of antigen that binds to the agent in the biological sample. Polynucleotide primers and probes may be used to detect the level of mRNA encoding reproductive system related antigen polypeptides, which is also indicative of the presence or absence of a reproductive system disease or disorder, including cancer. In general, reproductive system related antigen polypeptides should be present at a level that is at least three fold higher in diseased tissue than in normal tissue.

[0431] There are a variety of assay formats known to those of ordinary skill in the art for using a binding agent to detect polypeptide markers in a sample. See, e.g., Harlow and Lane, *supra*. In general, the presence or absence of a reproductive system disease in a patient may be determined by (a) contacting a biological sample obtained from a patient with a binding agent; (b) detecting in the sample a level of polypeptide that binds to the binding agent; and (c) comparing the level of polypeptide with a predetermined cut-off value.

[0432] In a preferred embodiment, the assay involves the use of binding agent immobilized on a solid support to bind to and remove the reproductive system related antigen polypeptide of the invention from the remainder of the sample. The bound polypeptide may then be detected using a detection reagent that contains a reporter group and specifically binds to the binding agent/polypeptide complex. Such detection reagents may comprise, for example, a binding agent that specifically binds to the polypeptide or an antibody or other agent that specifically binds to the binding agent, such as an anti-immunoglobulin, protein G, protein A or a lectin. Alternatively, a competitive assay may be utilized, in which a polypeptide is labeled with a reporter group and allowed to bind to the immobilized binding agent after incubation of the binding agent with the sample. The extent to which components of the sample inhibit the binding of the labeled polypeptide to the binding agent is indicative of the reactivity of the sample with the immobilized binding agent. Suitable polypeptides for

use within such assays include reproductive system related antigen polypeptides and portions thereof, or antibodies, to which the binding agent binds, as described above.

[0433] The solid support may be any material known to those of skill in the art to which reproductive system related antigen polypeptides of the invention may be attached. For example, the solid support may be a test well in a microtiter plate or a nitrocellulose or other suitable membrane. Alternatively, the support may be a bead or disc, such as glass fiberglass, latex or a plastic material such as polystyrene or polyvinylchloride. The support may also be a magnetic particle or a fiber optic sensor, such as those disclosed, for example, in U.S. Patent No. 5,359,681. The binding agent may be immobilized on the solid support using a variety of techniques known to those of skill in the art, which are amply described in the patent and scientific literature. In the context of the present invention, the term "immobilization" refers to both noncovalent association, such as adsorption, and covalent attachment (which may be a direct linkage between the agent and functional groups on the support or may be a linkage by way of a cross-linking agent). Immobilization by adsorption to a well in a microtiter plate or to a membrane is preferred. In such cases, adsorption may be achieved by contacting the binding agent, in a suitable buffer, with the solid support for the suitable amount of time. The contact time varies with temperature, but is typically between about 1 hour and about 1 day. In general, contacting a well of plastic microtiter plate (such as polystyrene or polyvinylchloride) with an amount of binding agent ranging from about 10 ng to about 10 ug, and preferably about 100 ng to about 1 ug, is sufficient to immobilize an adequate amount of binding agent.

[0434] Covalent attachment of binding agent to a solid support may generally be achieved by first reacting the support with a bifunctional reagent that will react with both the support and a functional group, such as a hydroxyl or amino group, on the binding agent. For example, the binding agent may be covalently attached to supports having an appropriate polymer coating using benzoquinone or by condensation of an aldehyde group on the support with an amine and an active hydrogen on the binding partner (see, e.g., Pierce Immunotechnology Catalog and Handbook, 1991, at A12-A13).

Gene Therapy Methods

[0435] Also encompassed by the present invention are gene therapy methods for treating or preventing disorders, diseases and conditions. The gene therapy methods relate to the introduction of nucleic acid (DNA, RNA and antisense DNA or RNA) sequences into an animal to achieve expression of a reproductive system related antigen of the present invention. This method requires a polynucleotide which codes for a polypeptide of the present invention operatively linked to a promoter and any other genetic elements necessary for the expression of the polypeptide by the target tissue. Such gene therapy and delivery techniques are known in the art, see, for example, WO90/11092, which is herein incorporated by reference.

[0436] Thus, for example, cells from a patient may be engineered with a polynucleotide (DNA or RNA) comprising a promoter operably linked to a polynucleotide of the present invention ex vivo, with the engineered cells then being provided to a patient to be treated with the polypeptide of the present invention. Such methods are well-known in the art. For example, see Beldegrun, A., et al., J. Natl. Cancer Inst. 85: 207-216 (1993); Ferrantini, M. et al., Cancer Research 53: 1107-1112 (1993); Ferrantini, M. et al., J. Immunology 153: 4604-4615 (1994); Kaido, T., et al., Int. J. Cancer 60: 221-229 (1995); Ogura, H., et al., Cancer Research 50: 5102-5106 (1990); Santodonato, L., et al., Human Gene Therapy 7:1-10 (1996); Santodonato, L., et al., Gene Therapy 4:1246-1255 (1997); and Zhang, J.-F. et al., Cancer Gene Therapy 3: 31-38 (1996)), which are herein incorporated by reference. In one embodiment, the cells which are engineered are arterial cells. The arterial cells may be reintroduced into the patient through direct injection to the artery, the tissues surrounding the artery, or through catheter injection.

[0437] As discussed in more detail below, the polynucleotide constructs can be delivered by any method that delivers injectable materials to the cells of an animal, such as, injection into the interstitial space of tissues (heart, muscle, skin, lung, liver, and the like). The polynucleotide constructs may be delivered in a pharmaceutically acceptable liquid or aqueous carrier.

[0438] In one embodiment, the polynucleotide of the present invention is delivered as a naked polynucleotide. The term "naked" polynucleotide, DNA or RNA refers to sequences that are free from any delivery vehicle that acts to assist, promote or

facilitate entry into the cell, including viral sequences, viral particles, liposome formulations, lipofectin or precipitating agents and the like. However, the polynucleotide of the present invention can also be delivered in liposome formulations and lipofectin formulations and the like can be prepared by methods well known to those skilled in the art. Such methods are described, for example, in U.S. Patent Nos. 5,593,972, 5,589,466, and 5,580,859, which are herein incorporated by reference.

[0439] The polynucleotide vector constructs used in the gene therapy method are preferably constructs that will not integrate into the host genome nor will they contain sequences that allow for replication. Appropriate vectors include pWLNEO, pSV2CAT, pOG44, pXT1 and pSG available from Stratagene; pSVK3, pBPV, pMSG and pSVL available from Pharmacia; and pEF1/V5, pcDNA3.1, and pRc/CMV2 available from Invitrogen. Other suitable vectors will be readily apparent to the skilled artisan.

[0440] Any strong promoter known to those skilled in the art can be used for driving the expression of the polynucleotide sequence. Suitable promoters include adenoviral promoters, such as the adenoviral major late promoter; or heterologous promoters, such as the cytomegalovirus (CMV) promoter; the respiratory syncytial virus (RSV) promoter; inducible promoters, such as the MMT promoter, the metallothionein promoter; heat shock promoters; the albumin promoter; the ApoA1 promoter; human globin promoters; viral thymidine kinase promoters, such as the Herpes Simplex thymidine kinase promoter; retroviral LTRs; the b-actin promoter; and human growth hormone promoters. The promoter also may be the native promoter for the polynucleotide of the present invention.

[0441] Unlike other gene therapy techniques, one major advantage of introducing naked nucleic acid sequences into target cells is the transitory nature of the polynucleotide synthesis in the cells. Studies have shown that non-replicating DNA sequences can be introduced into cells to provide production of the desired polypeptide for periods of up to six months.

[0442] The polynucleotide construct can be delivered to the interstitial space of tissues within the an animal, including of muscle, skin, brain, lung, liver, spleen, bone marrow, thymus, heart, lymph, blood, bone, cartilage, pancreas, kidney, gall bladder, stomach, intestine, testis, ovary, uterus, rectum, nervous system, eye, gland, and

connective tissue. Interstitial space of the tissues comprises the intercellular, fluid, mucopolysaccharide matrix among the reticular fibers of organ tissues, elastic fibers in the walls of vessels or chambers, collagen fibers of fibrous tissues, or that same matrix within connective tissue ensheathing muscle cells or in the lacunae of bone. It is similarly the space occupied by the plasma of the circulation and the lymph fluid of the lymphatic channels. Delivery to the interstitial space of muscle tissue is preferred for the reasons discussed below. They may be conveniently delivered by injection into the tissues comprising these cells. They are preferably delivered to and expressed in persistent, non-dividing cells which are differentiated, although delivery and expression may be achieved in non-differentiated or less completely differentiated cells, such as, for example, stem cells of blood or skin fibroblasts. *In vivo* muscle cells are particularly competent in their ability to take up and express polynucleotides.

[0443] For the naked nucleic acid sequence injection, an effective dosage amount of DNA or RNA will be in the range of from about 0.05 mg/kg body weight to about 50 mg/kg body weight. Preferably the dosage will be from about 0.005 mg/kg to about 20 mg/kg and more preferably from about 0.05 mg/kg to about 5 mg/kg. Of course, as the artisan of ordinary skill will appreciate, this dosage will vary according to the tissue site of injection. The appropriate and effective dosage of nucleic acid sequence can readily be determined by those of ordinary skill in the art and may depend on the condition being treated and the route of administration.

[0444] The preferred route of administration is by the parenteral route of injection into the interstitial space of tissues. However, other parenteral routes may also be used, such as, inhalation of an aerosol formulation particularly for delivery to lungs or bronchial tissues, throat or mucous membranes of the nose. In addition, naked DNA constructs can be delivered to arteries during angioplasty by the catheter used in the procedure.

[0445] The naked polynucleotides are delivered by any method known in the art, including, but not limited to, direct needle injection at the delivery site, intravenous injection, topical administration, catheter infusion, and so-called "gene guns". These delivery methods are known in the art.

[0446] The constructs may also be delivered with delivery vehicles such as viral sequences, viral particles, liposome formulations, lipofectin, precipitating agents, etc. Such methods of delivery are known in the art.

[0447] In certain embodiments, the polynucleotide constructs are complexed in a liposome preparation. Liposomal preparations for use in the instant invention include cationic (positively charged), anionic (negatively charged) and neutral preparations. However, cationic liposomes are particularly preferred because a tight charge complex can be formed between the cationic liposome and the polyanionic nucleic acid. Cationic liposomes have been shown to mediate intracellular delivery of plasmid DNA (Felgner et al., Proc. Natl. Acad. Sci. USA (1987) 84:7413-7416, which is herein incorporated by reference); mRNA (Malone et al., Proc. Natl. Acad. Sci. USA (1989) 86:6077-6081, which is herein incorporated by reference); and purified transcription factors (Debs et al., J. Biol. Chem. (1990) 265:10189-10192, which is herein incorporated by reference), in functional form.

[0448] Cationic liposomes are readily available. For example, N[1-2,3-dioleoyloxy)propyl]-N,N,N-triethylammonium (DOTMA) liposomes are particularly useful and are available under the trademark Lipofectin, from GIBCO BRL, Grand Island, N.Y., (see, also, Felgner et al., Proc. Natl. Acad. Sci. USA (1987) 84:7413-7416, which is herein incorporated by reference). Other commercially available liposomes include transfectace (DDAB/DOPE) and DOTAP/DOPE (Boehringer).

[0449] Other cationic liposomes can be prepared from readily available materials using techniques well known in the art. See, e.g. PCT Publication No. WO 90/11092 (which is herein incorporated by reference) for a description of the synthesis of DOTAP (1,2-bis(oleoyloxy)-3-(trimethylammonio)propane) liposomes. Preparation of DOTMA liposomes is explained in the literature, see, e.g., P. Felgner et al., Proc. Natl. Acad. Sci. USA 84:7413-7417, which is herein incorporated by reference. Similar methods can be used to prepare liposomes from other cationic lipid materials.

[0450] Similarly, anionic and neutral liposomes are readily available, such as from Avanti Polar Lipids (Birmingham, Ala.), or can be easily prepared using readily available materials. Such materials include phosphatidyl choline, cholesterol, phosphatidyl ethanolamine, dioleoylphosphatidyl choline (DOPC),

dioleoylphosphatidyl glycerol (DOPG), dioleoylphosphatidyl ethanolamine (DOPE), among others. These materials can also be mixed with the DOTMA and DOTAP starting materials in appropriate ratios. Methods for making liposomes using these materials are well known in the art.

[0451] For example, commercially dioleoylphosphatidyl choline (DOPC), dioleoylphosphatidyl glycerol (DOPG), and dioleoylphosphatidyl ethanolamine (DOPE) can be used in various combinations to make conventional liposomes, with or without the addition of cholesterol. Thus, for example, DOPG/DOPC vesicles can be prepared by drying 50 mg each of DOPG and DOPC under a stream of nitrogen gas into a sonication vial. The sample is placed under a vacuum pump overnight and is hydrated the following day with deionized water. The sample is then sonicated for 2 hours in a capped vial, using a Heat Systems model 350 sonicator equipped with an inverted cup (bath type) probe at the maximum setting while the bath is circulated at 15EC. Alternatively, negatively charged vesicles can be prepared without sonication to produce multilamellar vesicles or by extrusion through nucleopore membranes to produce unilamellar vesicles of discrete size. Other methods are known and available to those of skill in the art.

[0452] The liposomes can comprise multilamellar vesicles (MLVs), small unilamellar vesicles (SUVs), or large unilamellar vesicles (LUVs), with SUVs being preferred. The various liposome-nucleic acid complexes are prepared using methods well known in the art. See, e.g., Straubinger et al., *Methods of Immunology* (1983), 101:512-527, which is herein incorporated by reference. For example, MLVs containing nucleic acid can be prepared by depositing a thin film of phospholipid on the walls of a glass tube and subsequently hydrating with a solution of the material to be encapsulated. SUVs are prepared by extended sonication of MLVs to produce a homogeneous population of unilamellar liposomes. The material to be entrapped is added to a suspension of preformed MLVs and then sonicated. When using liposomes containing cationic lipids, the dried lipid film is resuspended in an appropriate solution such as sterile water or an isotonic buffer solution such as 10 mM Tris/NaCl, sonicated, and then the preformed liposomes are mixed directly with the DNA. The liposome and DNA form a very stable complex due to binding of the positively charged liposomes to the cationic DNA. SUVs find use with small nucleic acid

fragments. LUVs are prepared by a number of methods, well known in the art. Commonly used methods include Ca^{2+} -EDTA chelation (Papahadjopoulos et al., Biochim. Biophys. Acta (1975) 394:483; Wilson et al., Cell 17:77 (1979); ether injection (Deamer, D. and Bangham, A., Biochim. Biophys. Acta 443:629 (1976); Ostro et al., Biochem. Biophys. Res. Commun. 76:836 (1977); Fraley et al., Proc. Natl. Acad. Sci. USA 76:3348 (1979)); detergent dialysis (Enoch, H. and Strittmatter, P., Proc. Natl. Acad. Sci. USA 76:145 (1979)); and reverse-phase evaporation (REV) (Fraley et al., J. Biol. Chem. 255:10431 (1980); Szoka et al., Proc. Natl. Acad. Sci. USA 75:145 (1978); Schaefer-Ridder et al., Science 215:166 (1982)), which are herein incorporated by reference.

[0453] Generally, the ratio of DNA to liposomes will be from about 10:1 to about 1:10. Preferably, the ration will be from about 5:1 to about 1:5. More preferably, the ration will be about 3:1 to about 1:3. Still more preferably, the ratio will be about 1:1.

[0454] U.S. Patent No. 5,676,954 (which is herein incorporated by reference) reports on the injection of genetic material, complexed with cationic liposomes carriers, into mice. U.S. Patent Nos. 4,897,355, 4,946,787, 5,049,386, 5,459,127, 5,589,466, 5,693,622, 5,580,859, 5,703,055, and international publication no. WO 94/9469 (which are herein incorporated by reference) provide cationic lipids for use in transfecting DNA into cells and mammals. U.S. Patent Nos. 5,589,466, 5,693,622, 5,580,859, 5,703,055, and International Publication No. WO 94/9469 provide methods for delivering DNA-cationic lipid complexes to mammals.

[0455] In certain embodiments, cells are engineered, *ex vivo* or *in vivo*, using a retroviral particle containing RNA which comprises a sequence encoding a polypeptide of the present invention. Retroviruses from which the retroviral plasmid vectors may be derived include, but are not limited to, Moloney Murine Leukemia Virus, spleen necrosis virus, Rous sarcoma Virus, Harvey Sarcoma Virus, avian leukosis virus, gibbon ape leukemia virus, human immunodeficiency virus, Myeloproliferative Sarcoma Virus, and mammary tumor virus.

[0456] The retroviral plasmid vector is employed to transduce packaging cell lines to form producer cell lines. Examples of packaging cells which may be transfected include, but are not limited to, the PE501, PA317, R-2, R-AM, PA12, T19-14X, VT-19-17-H2, RCRE, RCRIP, GP+E-86, GP+envAm12, and DAN cell lines as described

in Miller, Human Gene Therapy 1:5-14 (1990), which is incorporated herein by reference in its entirety. The vector may transduce the packaging cells through any means known in the art. Such means include, but are not limited to, electroporation, the use of liposomes, and CaPO_4 precipitation. In one alternative, the retroviral plasmid vector may be encapsulated into a liposome, or coupled to a lipid, and then administered to a host.

[0457] The producer cell line generates infectious retroviral vector particles which include polynucleotide encoding a polypeptide of the present invention. Such retroviral vector particles then may be employed, to transduce eukaryotic cells, either *in vitro* or *in vivo*. The transduced eukaryotic cells will express a polypeptide of the present invention.

[0458] In certain other embodiments, cells are engineered, *ex vivo* or *in vivo*, with polynucleotide contained in an adenovirus vector. Adenovirus can be manipulated such that it encodes and expresses a polypeptide of the present invention, and at the same time is inactivated in terms of its ability to replicate in a normal lytic viral life cycle. Adenovirus expression is achieved without integration of the viral DNA into the host cell chromosome, thereby alleviating concerns about insertional mutagenesis. Furthermore, adenoviruses have been used as live enteric vaccines for many years with an excellent safety profile (Schwartz, et al., Am. Rev. Respir. Dis. 109:233-238 (1974)). Finally, adenovirus mediated gene transfer has been demonstrated in a number of instances including transfer of alpha-1-antitrypsin and CFTR to the lungs of cotton rats (Rosenfeld et al., Science 252:431-434 (1991); Rosenfeld et al., Cell 68:143-155 (1991)). Furthermore, extensive studies to attempt to establish adenovirus as a causative agent in human cancer were uniformly negative (Green et al., Proc. Natl. Acad. Sci. USA 76:6606 (1979)).

[0459] Suitable adenoviral vectors useful in the present invention are described, for example, in Kozarsky and Wilson, Curr. Opin. Genet. Devel. 3:499-503 (1993); Rosenfeld et al., Cell 68:143-155 (1992); Engelhardt et al., Human Genet. Ther. 4:759-769 (1993); Yang et al., Nature Genet. 7:362-369 (1994); Wilson et al., Nature 365:691-692 (1993); and U.S. Patent No. 5,652,224, which are herein incorporated by reference. For example, the adenovirus vector Ad2 is useful and can be grown in human 293 cells. These cells contain the E1 region of adenovirus and constitutively

express Ela and Elb, which complement the defective adenoviruses by providing the products of the genes deleted from the vector. In addition to Ad2, other varieties of adenovirus (e.g., Ad3, Ad5, and Ad7) are also useful in the present invention.

[0460] Preferably, the adenoviruses used in the present invention are replication deficient. Replication deficient adenoviruses require the aid of a helper virus and/or packaging cell line to form infectious particles. The resulting virus is capable of infecting cells and can express a polynucleotide of interest which is operably linked to a promoter, but cannot replicate in most cells. Replication deficient adenoviruses may be deleted in one or more of all or a portion of the following genes: Ela, Elb, E3, E4, E2a, or L1 through L5.

[0461] In certain other embodiments, the cells are engineered, *ex vivo* or *in vivo*, using an adeno-associated virus (AAV). AAVs are naturally occurring defective viruses that require helper viruses to produce infectious particles (Muzyczka, N., *Curr. Topics in Microbiol. Immunol.* 158:97 (1992)). It is also one of the few viruses that may integrate its DNA into non-dividing cells. Vectors containing as little as 300 base pairs of AAV can be packaged and can integrate, but space for exogenous DNA is limited to about 4.5 kb. Methods for producing and using such AAVs are known in the art. See, for example, U.S. Patent Nos. 5,139,941, 5,173,414, 5,354,678, 5,436,146, 5,474,935, 5,478,745, and 5,589,377.

[0462] For example, an appropriate AAV vector for use in the present invention will include all the sequences necessary for DNA replication, encapsidation, and host-cell integration. The polynucleotide construct is inserted into the AAV vector using standard cloning methods, such as those found in Sambrook et al., *Molecular Cloning: A Laboratory Manual*, Cold Spring Harbor Press (1989). The recombinant AAV vector is then transfected into packaging cells which are infected with a helper virus, using any standard technique, including lipofection, electroporation, calcium phosphate precipitation, etc. Appropriate helper viruses include adenoviruses, cytomegaloviruses, vaccinia viruses, or herpes viruses. Once the packaging cells are transfected and infected, they will produce infectious AAV viral particles which contain the polynucleotide construct. These viral particles are then used to transduce eukaryotic cells, either *ex vivo* or *in vivo*. The transduced cells will contain the

polynucleotide construct integrated into its genome, and will express a polypeptide of the invention.

[0463] Another method of gene therapy involves operably associating heterologous control regions and endogenous reproductive system related antigen polynucleotide sequences (e.g., encoding a reproductive system related antigen polypeptide of the present invention) via homologous recombination (see, e.g., U.S. Patent No. 5,641,670, issued June 24, 1997; International Publication No. WO 96/29411, published September 26, 1996; International Publication No. WO 94/12650, published August 4, 1994; Koller et al., Proc. Natl. Acad. Sci. USA 86:8932-8935 (1989); and Zijlstra et al., Nature 342:435-438 (1989), which are herein incorporated by reference. This method involves the activation of a gene which is present in the target cells, but which is not normally expressed in the cells, or is expressed at a lower level than desired.

[0464] Polynucleotide constructs are made, using standard techniques known in the art, which contain the promoter with targeting sequences flanking the promoter. Suitable promoters are described herein. The targeting sequence is sufficiently complementary to an endogenous sequence to permit homologous recombination of the promoter-targeting sequence with the endogenous sequence. The targeting sequence will be sufficiently near the 5' end of the desired endogenous polynucleotide sequence so the promoter will be operably linked to the endogenous sequence upon homologous recombination.

[0465] The promoter and the targeting sequences can be amplified using PCR. Preferably, the amplified promoter contains distinct restriction enzyme sites on the 5' and 3' ends. Preferably, the 3' end of the first targeting sequence contains the same restriction enzyme site as the 5' end of the amplified promoter and the 5' end of the second targeting sequence contains the same restriction site as the 3' end of the amplified promoter. The amplified promoter and targeting sequences are digested and ligated together.

[0466] The promoter-targeting sequence construct is delivered to the cells, either as naked polynucleotide, or in conjunction with transfection-facilitating agents, such as liposomes, viral sequences, viral particles, whole viruses, lipofection, precipitating agents, etc., described in more detail above. The P promoter-targeting sequence can

be delivered by any method, included direct needle injection, intravenous injection, topical administration, catheter infusion, particle accelerators, etc. The methods are described in more detail below.

[0467] The promoter-targeting sequence construct is taken up by cells. Homologous recombination between the construct and the endogenous sequence takes place, such that an endogenous sequence is placed under the control of the promoter. The promoter then drives the expression of the endogenous sequence.

[0468] The polynucleotide encoding a polypeptide of the present invention may contain a secretory signal sequence that facilitates secretion of the protein. Typically, the signal sequence is positioned in the coding region of the polynucleotide to be expressed towards or at the 5' end of the coding region. The signal sequence may be homologous or heterologous to the reproductive system related antigen polynucleotide of interest and may be homologous or heterologous to the cells to be transfected. Additionally, the signal sequence may be chemically synthesized using methods known in the art.

[0469] Any mode of administration of any of the above-described polynucleotides constructs can be used so long as the mode results in the expression of one or more molecules in an amount sufficient to provide a therapeutic effect. This includes direct needle injection, systemic injection, catheter infusion, biolistic injectors, particle accelerators (i.e., "gene guns"), gelfoam sponge depots, other commercially available depot materials, osmotic pumps (e.g., Alza minipumps), oral or suppositorial solid (tablet or pill) pharmaceutical formulations, and decanting or topical applications during surgery. For example, direct injection of naked calcium phosphate-precipitated plasmid into rat liver and rat spleen or a protein-coated plasmid into the portal vein has resulted in gene expression of the foreign gene in the rat livers (Kaneda et al., Science 243:375 (1989)).

[0470] A preferred method of local administration is by direct injection. Preferably, a recombinant molecule of the present invention complexed with a delivery vehicle is administered by direct injection into or locally within the area of arteries. Administration of a composition locally within the area of arteries refers to injecting the composition centimeters and preferably, millimeters within arteries.

[0471] Another method of local administration is to contact a polynucleotide construct of the present invention in or around a surgical wound. For example, a patient can undergo surgery and the polynucleotide construct can be coated on the surface of tissue inside the wound or the construct can be injected into areas of tissue inside the wound.

[0472] Therapeutic compositions useful in systemic administration, include recombinant molecules of the present invention complexed to a targeted delivery vehicle of the present invention. Suitable delivery vehicles for use with systemic administration comprise liposomes comprising ligands for targeting the vehicle to a particular site. In specific embodiments, suitable delivery vehicles for use with systemic administration comprise liposomes comprising polypeptides of the invention for targeting the vehicle to a particular site.

[0473] Preferred methods of systemic administration, include intravenous injection, aerosol, oral and percutaneous (topical) delivery. Intravenous injections can be performed using methods standard in the art. Aerosol delivery can also be performed using methods standard in the art (see, for example, Stribling et al., Proc. Natl. Acad. Sci. USA 189:11277-11281, 1992, which is incorporated herein by reference). Oral delivery can be performed by complexing a polynucleotide construct of the present invention to a carrier capable of withstanding degradation by digestive enzymes in the gut of an animal. Examples of such carriers, include plastic capsules or tablets, such as those known in the art. Topical delivery can be performed by mixing a polynucleotide construct of the present invention with a lipophilic reagent (e.g., DMSO) that is capable of passing into the skin.

[0474] Determining an effective amount of substance to be delivered can depend upon a number of factors including, for example, the chemical structure and biological activity of the substance, the age and weight of the animal, the precise condition requiring treatment and its severity, and the route of administration. The frequency of treatments depends upon a number of factors, such as the amount of polynucleotide constructs administered per dose, as well as the health and history of the subject. The precise amount, number of doses, and timing of doses will be determined by the attending physician or veterinarian.

[0475] Therapeutic compositions of the present invention can be administered to any animal, preferably to mammals and birds. Preferred mammals include humans, dogs, cats, mice, rats, rabbits sheep, cattle, horses and pigs, with humans being particularly preferred.

Biological Activities

[0476] Polynucleotides or polypeptides, or agonists or antagonists of the present invention, can be used in assays to test for one or more biological activities. If these polynucleotides or polypeptides, or agonists or antagonists of the present invention, do exhibit activity in a particular assay, it is likely that these molecules may be involved in the diseases associated with the biological activity. Thus, the polynucleotides and polypeptides, and agonists or antagonists could be used to treat, prevent diagnose and/or prognose the associated disease.

[0477] The reproductive system related antigen polynucleotides and polypeptides of the invention are predicted to have predominant expression in tissues of the reproductive system.

[0478] Thus, the reproductive system related antigens of the invention may be useful as therapeutic molecules. Each would be useful for diagnosis, detection, treatment and/or prevention of diseases or disorders of the reproductive system, including, for example, injury and trauma, infections, neoplastic disorders, congenital defects, and diseases or disorders which result in infertility, complications with pregnancy, labor, or parturition, postpartum difficulties, and/or as described below in the section entitled "Reproductive System Disorders".

[0479] In a preferred embodiment, polynucleotides of the invention (e.g., a nucleic acid sequence of SEQ ID NO:X or the complement thereof; or the cDNA sequence contained in Clone ID NO:Z, or fragments or variants thereof) and/or polypeptides of the invention (e.g., an amino acid sequence contained in SEQ ID NO:Y, an amino acid sequence encoded by SEQ ID NO:X, or the complement thereof, an amino acid sequence encoded by the cDNA sequence contained in Clone ID NO:Z and fragments or variants thereof as described herein) are useful for the diagnosis, detection, treatment, and/or prevention of diseases or disorders of the tissues/cells corresponding to the library source disclosed in column 7 of Table 1A expressing the

corresponding reproductive system related sequence disclosed in the same row of Table 1A.

[0480] Particularly, the reproductive system related antigens may be a useful therapeutic for cancers of the reproductive system. Treatment, diagnosis, detection, and/or prevention of disorders of the reproductive system could be carried out using a reproductive system related antigen or soluble form of a reproductive system related antigen, a reproductive system related antigen ligand, gene therapy, or ex vivo applications. Moreover, inhibitors of a reproductive system related antigen, either blocking antibodies or mutant forms, could modulate the expression of the reproductive system related antigen. These inhibitors may be useful to treat, diagnose, detect, and/or prevent diseases associated with the misregulation of a reproductive system related antigen.

[0481] In one embodiment, the invention provides a method for the specific delivery of compositions of the invention to cells (e.g., normal or diseased reproductive system cells) by administering polypeptides of the invention (e.g., reproductive system related antigen polypeptides or anti-reproductive system related antigen antibodies) that are associated with heterologous polypeptides or nucleic acids. In one example, the invention provides a method for delivering a therapeutic protein into the targeted cell (e.g., an aberrant reproductive system cell or reproductive system cancer cell). In another example, the invention provides a method for delivering a single stranded nucleic acid (e.g., antisense or ribozymes) or double stranded nucleic acid (e.g., DNA that can integrate into the cell's genome or replicate episomally and that can be transcribed) into the targeted cell.

[0482] In another embodiment, the invention provides a method for the specific destruction of cells (e.g., the destruction of aberrant reproductive system cells, including, but not limited to, reproductive system tumor cells) by administering polypeptides of the invention (e.g., reproductive system related antigen polypeptides or fragments thereof, or anti-reproductive system related antigen antibodies) in association with toxins or cytotoxic prodrugs.

[0483] By "toxin" is meant compounds that bind and activate endogenous cytotoxic effector systems, radioisotopes, holotoxins, modified toxins, catalytic subunits of toxins, cytotoxins (cytotoxic agents), or any molecules or enzymes not

normally present in or on the surface of a cell that under defined conditions cause the cell's death. Toxins that may be used according to the methods of the invention include, but are not limited to, radioisotopes known in the art, compounds such as, for example, antibodies (or complement fixing containing portions thereof) that bind an inherent or induced endogenous cytotoxic effector system, thymidine kinase, endonuclease, RNase, alpha toxin, ricin, abrin, *Pseudomonas* exotoxin A, diphtheria toxin, saporin, momordin, gelonin, pokeweed antiviral protein, alpha-sarcin and cholera toxin. "Toxin" also includes a cytostatic or cytotoxic agent, a therapeutic agent or a radioactive metal ion, e.g., alpha-emitters such as, for example, ^{213}Bi , or other radioisotopes such as, for example, ^{103}Pd , ^{133}Xe , ^{131}I , ^{68}Ge , ^{57}Co , ^{65}Zn , ^{85}Sr , ^{32}P , ^{35}S , ^{90}Y , ^{153}Sm , ^{153}Gd , ^{169}Yb , ^{51}Cr , ^{54}Mn , ^{75}Se , ^{113}Sn , $^{90}\text{Yttrium}$, ^{117}Tin , $^{186}\text{Rhenium}$, $^{166}\text{Holmium}$, and $^{188}\text{Rhenium}$; luminescent labels, such as luminol; and fluorescent labels, such as fluorescein and rhodamine, and biotin.

[0484] Techniques known in the art may be applied to label antibodies of the invention. Such techniques include, but are not limited to, the use of bifunctional conjugating agents (see e.g., U.S. Patent Nos. 5,756,065; 5,714,631; 5,696,239; 5,652,361; 5,505,931; 5,489,425; 5,435,990; 5,428,139; 5,342,604; 5,274,119; 4,994,560; and 5,808,003; the contents of each of which are hereby incorporated by reference in its entirety). A cytotoxin or cytotoxic agent includes any agent that is detrimental to cells. Examples include paclitaxol, cytochalasin B, gramicidin D, ethidium bromide, emetine, mitomycin, etoposide, tenoposide, vincristine, vinblastine, colchicin, doxorubicin, daunorubicin, dihydroxy anthracin dione, mitoxantrone, mithramycin, actinomycin D, 1-dehydrotestosterone, glucocorticoids, procaine, tetracaine, lidocaine, propranolol, and puromycin and analogs or homologs thereof. Therapeutic agents include, but are not limited to, antimetabolites (e.g., methotrexate, 6-mercaptopurine, 6-thioguanine, cytarabine, 5-fluorouracil decarbazine), alkylating agents (e.g., mechlorethamine, thioepa chlorambucil, melphalan, carmustine (BSNU) and lomustine (CCNU), cyclophosphamide, busulfan, dibromomannitol, streptozotocin, mitomycin C, and cis- dichlorodiamine platinum (II) (DDP) cisplatin), anthracyclines (e.g., daunorubicin (formerly daunomycin) and doxorubicin), antibiotics (e.g., dactinomycin (formerly actinomycin), bleomycin, mithramycin, and anthramycin (AMC)), and anti-mitotic agents (e.g., vincristine and vinblastine).

[0485] By "cytotoxic prodrug" is meant a non-toxic compound that is converted by an enzyme, normally present in the cell, into a cytotoxic compound. Cytotoxic prodrugs that may be used according to the methods of the invention include, but are not limited to, glutamyl derivatives of benzoic acid mustard alkylating agent, phosphate derivatives of etoposide or mitomycin C, cytosine arabinoside, daunorubisin, and phenoxyacetamide derivatives of doxorubicin.

[0486] It will be appreciated that conditions caused by a decrease in the standard or normal level of a reproductive system related antigen activity in an individual, particularly disorders of the reproductive system, can be treated by administration of a reproductive system related antigen polypeptide (e.g., such as, for example, the complete reproductive system related antigen polypeptide, the soluble form of the extracellular domain of a reproductive system related antigen polypeptide, or cells expressing the complete protein) or agonist. Thus, the invention also provides a method of treatment of an individual in need of an increased level of reproductive system related antigen activity comprising administering to such an individual a pharmaceutical composition comprising an amount of an isolated reproductive system related antigen polypeptide of the invention, or agonist thereof (e.g., an agonistic anti-reproductive system related antigen antibody), effective to increase the reproductive system related antigen activity level in such an individual.

[0487] It will also be appreciated that conditions caused by a increase in the standard or normal level of reproductive system related antigen activity in an individual, particularly disorders of the reproductive system, can be treated by administration of reproductive system related antigen polypeptides (e.g., such as, for example, the complete reproductive system related antigen polypeptide, the soluble form of the extracellular domain of a reproductive system related antigen polypeptide, or cells expressing the complete protein) or antagonist (e.g., an antagonistic reproductive system related antigen antibody). Thus, the invention also provides a method of treatment of an individual in need of an decreased level of reproductive system related antigen activity comprising administering to such an individual a pharmaceutical composition comprising an amount of an isolated reproductive system related antigen polypeptide of the invention, or antagonist thereof (e.g., an antagonistic

anti- reproductive system related antigen antibody), effective to decrease the reproductive system related antigen activity level in such an individual.

[0488] In certain embodiments, a polypeptide of the invention, or polynucleotides, antibodies, agonists, or antagonists corresponding to that polypeptide, may be used to diagnose and/or prognose diseases and/or disorders associated with the tissue(s) in which the polypeptide of the invention is expressed, including one, two, three, four, five, or more tissues disclosed in Table 1A, column 7 (Tissue Distribution Library Code).

[0489] More generally, polynucleotides, translation products and antibodies corresponding to this gene may be useful for the diagnosis, prognosis, prevention, and/or treatment of diseases and/or disorders associated with the following systems.

Reproductive System Disorders

[0490] The polynucleotides or polypeptides, or agonists or antagonists of the invention may be used for the diagnosis, treatment, or prevention of diseases and/or disorders of the reproductive system. Reproductive system disorders that can be treated by the compositions of the invention, include, but are not limited to, reproductive system injuries, infections, neoplastic disorders, congenital defects, and diseases or disorders which result in infertility, complications with pregnancy, labor, or parturition, and postpartum difficulties.

[0491] Reproductive system disorders and/or diseases include diseases and/or disorders of the testes, including, but not limited to, testicular atrophy, testicular feminization, cryptorchism (unilateral and bilateral), anorchia, ectopic testis, epididymitis and orchitis (typically resulting from infections such as, for example, gonorrhea, mumps, tuberculosis, and syphilis), testicular torsion, vasitis nodosa, germ cell tumors (e.g., seminomas, embryonal cell carcinomas, teratocarcinomas, choriocarcinomas, yolk sac tumors, and teratomas), stromal tumors (e.g., Leydig cell tumors), hydrocele, hematocele, varicocele, spermatocele, inguinal hernia, and disorders of sperm production (e.g., immotile cilia syndrome, aspermia, asthenozoospermia, azoospermia, oligospermia, and teratozoospermia).

[0492] Reproductive system disorders also include, but are not limited to, disorders of the prostate gland, such as acute non-bacterial prostatitis, chronic non-bacterial prostatitis, acute bacterial prostatitis, chronic bacterial prostatitis, prostatodystonia, prostatosis, granulomatous prostatitis, malacoplakia, benign prostatic hypertrophy or hyperplasia, and prostate neoplastic disorders, including adenocarcinomas, transitional cell carcinomas, ductal carcinomas, and squamous cell carcinomas.

[0493] Additionally, the compositions of the invention may be useful in the diagnosis, treatment, and/or prevention of disorders or diseases of the penis and urethra, including, but not limited to, inflammatory disorders, such as balanoposthitis, balanitis xerotica obliterans, phimosis, paraphimosis, syphilis, herpes simplex virus, gonorrhea, non-gonococcal urethritis, chlamydia, mycoplasma, trichomonas, HIV, AIDS, Reiter's syndrome, condyloma acuminatum, condyloma latum, and pearly penile papules; urethral abnormalities, such as hypospadias, epispadias, and phimosis; premalignant lesions, including Erythroplasia of Queyrat, Bowen's disease, Bowenoid papulosis, giant condyloma of Buscke-Lowenstein, and verrucous carcinoma; penile cancers, including squamous cell carcinomas, carcinoma in situ, verrucous carcinoma, and disseminated penile carcinoma; urethral neoplastic disorders, including penile urethral carcinoma, bulbomembranous urethral carcinoma, and prostatic urethral carcinoma; and erectile disorders, such as priapism, Peyronie's disease, erectile dysfunction, and impotence.

[0494] Moreover, diseases and/or disorders of the vas deferens include, but are not limited to, vasculitis and CBAVD (congenital bilateral absence of the vas deferens); additionally, the polynucleotides, polypeptides, and agonists or antagonists of the present invention may be used in the diagnosis, treatment, and/or prevention of diseases and/or disorders of the seminal vesicles, including but not limited to, hydatid disease, congenital chloride diarrhea, and polycystic kidney disease.

[0495] Other disorders and/or diseases of the male reproductive system that may be diagnosed, treated, and/or prevented with the compositions of the invention include, but are not limited to, Klinefelter's syndrome, Young's syndrome, premature ejaculation, diabetes mellitus, cystic fibrosis, Kartagener's syndrome, high fever, multiple sclerosis, and gynecomastia.

- [0496] Further, the polynucleotides, polypeptides, and agonists or antagonists of the present invention may be used in the diagnosis, treatment, and/or prevention of diseases and/or disorders of the vagina and vulva, including, but not limited to, bacterial vaginosis, candida vaginitis, herpes simplex virus, chancroid, granuloma inguinale, lymphogranuloma venereum, scabies, human papillomavirus, vaginal trauma, vulvar trauma, adenosis, chlamydia vaginitis, gonorrhea, trichomonas vaginitis, condyloma acuminatum, syphilis, molluscum contagiosum, atrophic vaginitis, Paget's disease, lichen sclerosus, lichen planus, vulvodynia, toxic shock syndrome, vaginismus, vulvovaginitis, vulvar vestibulitis, and neoplastic disorders, such as squamous cell hyperplasia, clear cell carcinoma, basal cell carcinoma, melanomas, cancer of Bartholin's gland, and vulvar intraepithelial neoplasia.
- [0497] Disorders and/or diseases of the uterus that may be diagnosed, treated, and/or prevented with the compositions of the invention include, but are not limited to, dysmenorrhea, retroverted uterus, endometriosis, fibroids, adenomyosis, anovulatory bleeding, amenorrhea, Cushing's syndrome, hydatidiform moles, Asherman's syndrome, premature menopause, precocious puberty, uterine polyps, dysfunctional uterine bleeding (e.g., due to aberrant hormonal signals), and neoplastic disorders, such as adenocarcinomas, leiomyosarcomas, and sarcomas. Additionally, the polypeptides, polynucleotides, or agonists or antagonists of the invention may be useful as a marker or detector of, as well as in the diagnosis, treatment, and/or prevention of congenital uterine abnormalities, such as bicornuate uterus, septate uterus, simple unicornuate uterus, unicornuate uterus with a noncavitary rudimentary horn, unicornuate uterus with a non-communicating cavitary rudimentary horn, unicornuate uterus with a communicating cavitary horn, arcuate uterus, uterine didelphys, and T-shaped uterus.
- [0498] Ovarian diseases and/or disorders that may be diagnosed, treated, and/or prevented with the compositions of the invention include, but are not limited to, anovulation, polycystic ovary syndrome (Stein-Leventhal syndrome), ovarian cysts, ovarian hypofunction, ovarian insensitivity to gonadotropins, ovarian overproduction of androgens, right ovarian vein syndrome, amenorrhea, hirsutism, and ovarian cancer (including, but not limited to, primary and secondary cancerous growth, Sertoli-Leydig tumors, endometrioid carcinoma of the ovary, ovarian papillary serous

adenocarcinoma, ovarian mucinous adenocarcinoma, and Ovarian Krukenberg tumors).

[0499] Cervical diseases and/or disorders that may be diagnosed, treated, and/or prevented with the compositions of the invention include, but are not limited to, cervicitis, chronic cervicitis, mucopurulent cervicitis, cervical dysplasia, cervical polyps, Nabothian cysts, cervical erosion, cervical incompetence, and cervical neoplasms (including, for example, cervical carcinoma, squamous metaplasia, squamous cell carcinoma, adenosquamous cell neoplasia, and columnar cell neoplasia).

[0500] Additionally, diseases and/or disorders of the reproductive system that may be diagnosed, treated, and/or prevented with the compositions of the invention include, but are not limited to, disorders and/or diseases of pregnancy, including miscarriage and stillbirth, such as early abortion, late abortion, spontaneous abortion, induced abortion, therapeutic abortion, threatened abortion, missed abortion, incomplete abortion, complete abortion, habitual abortion, missed abortion, and septic abortion; ectopic pregnancy, anemia, Rh incompatibility, vaginal bleeding during pregnancy, gestational diabetes, intrauterine growth retardation, polyhydramnios, HELLP syndrome, abruptio placentae, placenta previa, hyperemesis, preeclampsia, eclampsia, herpes gestationis, and urticaria of pregnancy. Additionally, the polynucleotides, polypeptides, and agonists or antagonists of the present invention may be used in the diagnosis, treatment, and/or prevention of diseases that can complicate pregnancy, including heart disease, heart failure, rheumatic heart disease, congenital heart disease, mitral valve prolapse, high blood pressure, anemia, kidney disease, infectious disease (e.g., rubella, cytomegalovirus, toxoplasmosis, infectious hepatitis, chlamydia, HIV, AIDS, and genital herpes), diabetes mellitus, Graves' disease, thyroiditis, hypothyroidism, Hashimoto's thyroiditis, chronic active hepatitis, cirrhosis of the liver, primary biliary cirrhosis, asthma, systemic lupus erythematosus, rheumatoid arthritis, myasthenia gravis, idiopathic thrombocytopenic purpura, appendicitis, ovarian cysts, gallbladder disorders, and obstruction of the intestine.

[0501] Complications associated with labor and parturition that may be diagnosed, treated, and/or prevented with the compositions of the invention include, but are not limited to, premature rupture of the membranes, pre-term labor, post-term pregnancy,

postmaturity, labor that progresses too slowly, fetal distress (e.g., abnormal heart rate (fetal or maternal), breathing problems, and abnormal fetal position), shoulder dystocia, prolapsed umbilical cord, amniotic fluid embolism, and aberrant uterine bleeding.

[0502] Further, diseases and/or disorders of the postdelivery period, that may be diagnosed, treated, and/or prevented with the compositions of the invention, include, but are not limited to, endometritis, myometritis, parametritis, peritonitis, pelvic thrombophlebitis, pulmonary embolism, endotoxemia, pyelonephritis, saphenous thrombophlebitis, mastitis, cystitis, postpartum hemorrhage, and inverted uterus.

[0503] Other disorders and/or diseases of the female reproductive system that may be diagnosed, treated, and/or prevented by the polynucleotides, polypeptides, and agonists or antagonists of the present invention include, but are not limited to, Turner's syndrome, pseudohermaphroditism, premenstrual syndrome, pelvic inflammatory disease, pelvic congestion (vascular engorgement), frigidity, anorgasmia, dyspareunia, ruptured fallopian tube, and Mittelschmerz.

Immune Activity

[0504] Polynucleotides, polypeptides, antibodies, and/or agonists or antagonists of the present invention may be useful in treating, preventing, diagnosing and/or prognosing diseases, disorders, and/or conditions of the immune system, by, for example, activating or inhibiting the proliferation, differentiation, or mobilization (chemotaxis) of immune cells. Immune cells develop through a process called hematopoiesis, producing myeloid (platelets, red blood cells, neutrophils, and macrophages) and lymphoid (B and T lymphocytes) cells from pluripotent stem cells. The etiology of these immune diseases, disorders, and/or conditions may be genetic, somatic, such as cancer and some autoimmune diseases, acquired (e.g., by chemotherapy or toxins), or infectious. Moreover, polynucleotides, polypeptides, antibodies, and/or agonists or antagonists of the present invention can be used as a marker or detector of a particular immune system disease or disorder.

[0505] In another embodiment, a polypeptide of the invention, or polynucleotides, antibodies, agonists, or antagonists corresponding to that polypeptide, may be used to treat diseases and disorders of the immune system and/or to inhibit or enhance an

immune response generated by cells associated with the tissue(s) in which the polypeptide of the invention is expressed, including one, two, three, four, five, or more tissues disclosed in Table 1A, column 7 (Tissue Distribution Library Code).

[0506] Polynucleotides, polypeptides, antibodies, and/or agonists or antagonists of the present invention may be useful in treating, preventing, diagnosing, and/or prognosing immunodeficiencies, including both congenital and acquired immunodeficiencies. Examples of B cell immunodeficiencies in which immunoglobulin levels B cell function and/or B cell numbers are decreased include: X-linked agammaglobulinemia (Bruton's disease), X-linked infantile agammaglobulinemia, X-linked immunodeficiency with hyper IgM, non X-linked immunodeficiency with hyper IgM, X-linked lymphoproliferative syndrome (XLP), agammaglobulinemia including congenital and acquired agammaglobulinemia, adult onset agammaglobulinemia, late-onset agammaglobulinemia, dysgammaglobulinemia, hypogammaglobulinemia, unspecified hypogammaglobulinemia, recessive agammaglobulinemia (Swiss type), Selective IgM deficiency, selective IgA deficiency, selective IgG subclass deficiencies, IgG subclass deficiency (with or without IgA deficiency), Ig deficiency with increased IgM, IgG and IgA deficiency with increased IgM, antibody deficiency with normal or elevated Igs, Ig heavy chain deletions, kappa chain deficiency, B cell lymphoproliferative disorder (BLPD), common variable immunodeficiency (CVID), common variable immunodeficiency (CVI) (acquired), and transient hypogammaglobulinemia of infancy.

[0507] In specific embodiments, ataxia-telangiectasia or conditions associated with ataxia-telangiectasia are treated, prevented, diagnosed, and/or prognosing using the polypeptides or polynucleotides of the invention, and/or agonists or antagonists thereof.

[0508] Examples of congenital immunodeficiencies in which T cell and/or B cell function and/or number is decreased include, but are not limited to: DiGeorge anomaly, severe combined immunodeficiencies (SCID) (including, but not limited to, X-linked SCID, autosomal recessive SCID, adenosine deaminase deficiency, purine nucleoside phosphorylase (PNP) deficiency, Class II MHC deficiency (Bare lymphocyte syndrome), Wiskott-Aldrich syndrome, and ataxia telangiectasia), thymic hypoplasia, third and fourth pharyngeal pouch syndrome, 22q11.2 deletion, chronic

mucocutaneous candidiasis, natural killer cell deficiency (NK), idiopathic CD4⁺ T-lymphocytopenia, immunodeficiency with predominant T cell defect (unspecified), and unspecified immunodeficiency of cell mediated immunity.

[0509] In specific embodiments, DiGeorge anomaly or conditions associated with DiGeorge anomaly are treated, prevented, diagnosed, and/or prognosed using polypeptides or polynucleotides of the invention, or antagonists or agonists thereof.

[0510] Other immunodeficiencies that may be treated, prevented, diagnosed, and/or prognosed using polypeptides or polynucleotides of the invention, and/or agonists or antagonists thereof, include, but are not limited to, chronic granulomatous disease, Chédiak-Higashi syndrome, myeloperoxidase deficiency, leukocyte glucose-6-phosphate dehydrogenase deficiency, X-linked lymphoproliferative syndrome (XLP), leukocyte adhesion deficiency, complement component deficiencies (including C1, C2, C3, C4, C5, C6, C7, C8 and/or C9 deficiencies), reticular dysgenesis, thymic aplasia, immunodeficiency with thymoma, severe congenital leukopenia, dysplasia with immunodeficiency, neonatal neutropenia, short limbed dwarfism, and Nezelof syndrome-combined immunodeficiency with Igs.

[0511] In a preferred embodiment, the immunodeficiencies and/or conditions associated with the immunodeficiencies recited above are treated, prevented, diagnosed and/or prognosed using polynucleotides, polypeptides, antibodies, and/or agonists or antagonists of the present invention.

[0512] In a preferred embodiment polynucleotides, polypeptides, antibodies, and/or agonists or antagonists of the present invention could be used as an agent to boost immunoresponsiveness among immunodeficient individuals. In specific embodiments, polynucleotides, polypeptides, antibodies, and/or agonists or antagonists of the present invention could be used as an agent to boost immunoresponsiveness among B cell and/or T cell immunodeficient individuals.

[0513] The polynucleotides, polypeptides, antibodies, and/or agonists or antagonists of the present invention may be useful in treating, preventing, diagnosing and/or prognosing autoimmune disorders. Many autoimmune disorders result from inappropriate recognition of self as foreign material by immune cells. This inappropriate recognition results in an immune response leading to the destruction of the host tissue. Therefore, the administration of polynucleotides and polypeptides of

the invention that can inhibit an immune response, particularly the proliferation, differentiation, or chemotaxis of T-cells, may be an effective therapy in preventing autoimmune disorders.

[0514] Autoimmune diseases or disorders that may be treated, prevented, diagnosed and/or prognosed by polynucleotides, polypeptides, antibodies, and/or agonists or antagonists of the present invention include, but are not limited to, one or more of the following: systemic lupus erythematosus, rheumatoid arthritis, ankylosing spondylitis, multiple sclerosis, autoimmune thyroiditis, Hashimoto's thyroiditis, autoimmune hemolytic anemia, hemolytic anemia, thrombocytopenia, autoimmune thrombocytopenia purpura, autoimmune neonatal thrombocytopenia, idiopathic thrombocytopenia purpura, purpura (e.g., Henoch-Schoenlein purpura), autoimmune cytopenia, Goodpasture's syndrome, Pemphigus vulgaris, myasthenia gravis, Grave's disease (hyperthyroidism), and insulin-resistant diabetes mellitus.

[0515] Additional disorders that are likely to have an autoimmune component that may be treated, prevented, and/or diagnosed with the compositions of the invention include, but are not limited to, type II collagen-induced arthritis, antiphospholipid syndrome, dermatitis, allergic encephalomyelitis, myocarditis, relapsing polychondritis, rheumatic heart disease, neuritis, uveitis, ophthalmia, polyendocrinopathies, Reiter's Disease, Stiff-Man Syndrome, autoimmune pulmonary inflammation, autism, Guillain-Barre Syndrome, insulin dependent diabetes mellitus, and autoimmune inflammatory eye disorders.

[0516] Additional disorders that are likely to have an autoimmune component that may be treated, prevented, diagnosed and/or prognosed with the compositions of the invention include, but are not limited to, scleroderma with anti-collagen antibodies (often characterized, e.g., by nucleolar and other nuclear antibodies), mixed connective tissue disease (often characterized, e.g., by antibodies to extractable nuclear antigens (e.g., ribonucleoprotein)), polymyositis (often characterized, e.g., by nonhistone ANA), pernicious anemia (often characterized, e.g., by antiparietal cell, microsomes, and intrinsic factor antibodies), idiopathic Addison's disease (often characterized, e.g., by humoral and cell-mediated adrenal cytotoxicity, infertility (often characterized, e.g., by antispermatozoal antibodies), glomerulonephritis (often characterized, e.g., by glomerular basement membrane antibodies or immune complexes), bullous

pemphigoid (often characterized, e.g., by IgG and complement in basement membrane), Sjogren's syndrome (often characterized, e.g., by multiple tissue antibodies, and/or a specific nonhistone ANA (SS-B)), diabetes mellitus (often characterized, e.g., by cell-mediated and humoral islet cell antibodies), and adrenergic drug resistance (including adrenergic drug resistance with asthma or cystic fibrosis) (often characterized, e.g., by beta-adrenergic receptor antibodies).

[0517] Additional disorders that may have an autoimmune component that may be treated, prevented, diagnosed and/or prognosed with the compositions of the invention include, but are not limited to, chronic active hepatitis (often characterized, e.g., by smooth muscle antibodies), primary biliary cirrhosis (often characterized, e.g., by mitochondria antibodies), other endocrine gland failure (often characterized, e.g., by specific tissue antibodies in some cases), vitiligo (often characterized, e.g., by melanocyte antibodies), vasculitis (often characterized, e.g., by Ig and complement in vessel walls and/or low serum complement), post-MI (often characterized, e.g., by myocardial antibodies), cardiomyopathy syndrome (often characterized, e.g., by myocardial antibodies), urticaria (often characterized, e.g., by IgG and IgM antibodies to IgE), atopic dermatitis (often characterized, e.g., by IgG and IgM antibodies to IgE), asthma (often characterized, e.g., by IgG and IgM antibodies to IgE), and many other inflammatory, granulomatous, degenerative, and atrophic disorders.

[0518] In a preferred embodiment, the autoimmune diseases and disorders and/or conditions associated with the diseases and disorders recited above are treated, prevented, diagnosed and/or prognosed using for example, antagonists or agonists, polypeptides or polynucleotides, or antibodies of the present invention. In a specific preferred embodiment, rheumatoid arthritis is treated, prevented, and/or diagnosed using polynucleotides, polypeptides, antibodies, and/or agonists or antagonists of the present invention.

[0519] In another specific preferred embodiment, systemic lupus erythematosus is treated, prevented, and/or diagnosed using polynucleotides, polypeptides, antibodies, and/or agonists or antagonists of the present invention. In another specific preferred embodiment, idiopathic thrombocytopenia purpura is treated, prevented, and/or diagnosed using polynucleotides, polypeptides, antibodies, and/or agonists or antagonists of the present invention.

- [0520] In another specific preferred embodiment IgA nephropathy is treated, prevented, and/or diagnosed using polynucleotides, polypeptides, antibodies, and/or agonists or antagonists of the present invention.
- [0521] In a preferred embodiment, the autoimmune diseases and disorders and/or conditions associated with the diseases and disorders recited above are treated, prevented, diagnosed and/or prognosed using polynucleotides, polypeptides, antibodies, and/or agonists or antagonists of the present invention.
- [0522] In preferred embodiments, polypeptides, antibodies, polynucleotides and/or agonists or antagonists of the present invention are used as a immunosuppressive agent(s).
- [0523] Polynucleotides, polypeptides, antibodies, and/or agonists or antagonists of the present invention may be useful in treating, preventing, prognosing, and/or diagnosing diseases, disorders, and/or conditions of hematopoietic cells. Polynucleotides, polypeptides, antibodies, and/or agonists or antagonists of the present invention could be used to increase differentiation and proliferation of hematopoietic cells, including the pluripotent stem cells, in an effort to treat or prevent those diseases, disorders, and/or conditions associated with a decrease in certain (or many) types hematopoietic cells, including but not limited to, leukopenia, neutropenia, anemia, and thrombocytopenia. Alternatively, Polynucleotides, polypeptides, antibodies, and/or agonists or antagonists of the present invention could be used to increase differentiation and proliferation of hematopoietic cells, including the pluripotent stem cells, in an effort to treat or prevent those diseases, disorders, and/or conditions associated with an increase in certain (or many) types of hematopoietic cells, including but not limited to, histiocytosis.
- [0524] Allergic reactions and conditions, such as asthma (particularly allergic asthma) or other respiratory problems, may also be treated, prevented, diagnosed and/or prognosed using polypeptides, antibodies, or polynucleotides of the invention, and/or agonists or antagonists thereof. Moreover, these molecules can be used to treat, prevent, prognose, and/or diagnose anaphylaxis, hypersensitivity to an antigenic molecule, or blood group incompatibility.
- [0525] Additionally, polypeptides or polynucleotides of the invention, and/or agonists or antagonists thereof, may be used to treat, prevent, diagnose and/or

prognose IgE-mediated allergic reactions. Such allergic reactions include, but are not limited to, asthma, rhinitis, and eczema. In specific embodiments, polynucleotides, polypeptides, antibodies, and/or agonists or antagonists of the present invention may be used to modulate IgE concentrations in vitro or in vivo.

[0526] Moreover, polynucleotides, polypeptides, antibodies, and/or agonists or antagonists of the present invention have uses in the diagnosis, prognosis, prevention, and/or treatment of inflammatory conditions. For example, since polypeptides, antibodies, or polynucleotides of the invention, and/or agonists or antagonists of the invention may inhibit the activation, proliferation and/or differentiation of cells involved in an inflammatory response, these molecules can be used to prevent and/or treat chronic and acute inflammatory conditions. Such inflammatory conditions include, but are not limited to, for example, inflammation associated with infection (e.g., septic shock, sepsis, or systemic inflammatory response syndrome), ischemia-reperfusion injury, endotoxin lethality, complement-mediated hyperacute rejection, nephritis, cytokine or chemokine induced lung injury, inflammatory bowel disease, Crohn's disease, over production of cytokines (e.g., TNF or IL-1.), respiratory disorders (e.g., asthma and allergy); gastrointestinal disorders (e.g., inflammatory bowel disease); cancers (e.g., gastric, ovarian, lung, bladder, liver, and breast); CNS disorders (e.g., multiple sclerosis; ischemic brain injury and/or stroke, traumatic brain injury, neurodegenerative disorders (e.g., Parkinson's disease and Alzheimer's disease); AIDS-related dementia; and prion disease); cardiovascular disorders (e.g., atherosclerosis, myocarditis, cardiovascular disease, and cardiopulmonary bypass complications); as well as many additional diseases, conditions, and disorders that are characterized by inflammation (e.g., hepatitis, rheumatoid arthritis, gout, trauma, pancreatitis, sarcoidosis, dermatitis, renal ischemia-reperfusion injury, Grave's disease, systemic lupus erythematosus, diabetes mellitus, and allogenic transplant rejection).

[0527] Because inflammation is a fundamental defense mechanism, inflammatory disorders can effect virtually any tissue of the body. Accordingly, polynucleotides, polypeptides, and antibodies of the invention, as well as agonists or antagonists thereof, have uses in the treatment of tissue-specific inflammatory disorders, including, but not limited to, adrenalitis, alveolitis, angiocholecystitis, appendicitis,

balanitis, blepharitis, bronchitis, bursitis, carditis, cellulitis, cervicitis, cholecystitis, chondritis, cochlitis, colitis, conjunctivitis, cystitis, dermatitis, diverticulitis, encephalitis, endocarditis, esophagitis, eustachitis, fibrositis, folliculitis, gastritis, gastroenteritis, gingivitis, glossitis, hepatosplenitis, keratitis, labyrinthitis, laryngitis, lymphangitis, mastitis, media otitis, meningitis, metritis, mucitis, myocarditis, myositis, myringitis, nephritis, neuritis, orchitis, osteochondritis, otitis, pericarditis, peritendonitis, peritonitis, pharyngitis, phlebitis, poliomyelitis, prostatitis, pulpitis, retinitis, rhinitis, salpingitis, scleritis, sclerochoroiditis, scrotitis, sinusitis, spondylitis, steatitis, stomatitis, synovitis, syringitis, tendonitis, tonsillitis, urethritis, and vaginitis.

[0528] In specific embodiments, polypeptides, antibodies, or polynucleotides of the invention, and/or agonists or antagonists thereof, are useful to diagnose, prognose, prevent, and/or treat organ transplant rejections and graft-versus-host disease. Organ rejection occurs by host immune cell destruction of the transplanted tissue through an immune response. Similarly, an immune response is also involved in GVHD, but, in this case, the foreign transplanted immune cells destroy the host tissues. Polypeptides, antibodies, or polynucleotides of the invention, and/or agonists or antagonists thereof, that inhibit an immune response, particularly the activation, proliferation, differentiation, or chemotaxis of T-cells, may be an effective therapy in preventing organ rejection or GVHD. In specific embodiments, polypeptides, antibodies, or polynucleotides of the invention, and/or agonists or antagonists thereof, that inhibit an immune response, particularly the activation, proliferation, differentiation, or chemotaxis of T-cells, may be an effective therapy in preventing experimental allergic and hyperacute xenograft rejection.

[0529] In other embodiments, polypeptides, antibodies, or polynucleotides of the invention, and/or agonists or antagonists thereof, are useful to diagnose, prognose, prevent, and/or treat immune complex diseases, including, but not limited to, serum sickness, post streptococcal glomerulonephritis, polyarteritis nodosa, and immune complex-induced vasculitis.

[0530] Polypeptides, antibodies, polynucleotides and/or agonists or antagonists of the invention can be used to treat, detect, and/or prevent infectious agents. For example, by increasing the immune response, particularly increasing the proliferation activation and/or differentiation of B and/or T cells, infectious diseases may be treated,

detected, and/or prevented. The immune response may be increased by either enhancing an existing immune response, or by initiating a new immune response. Alternatively, polynucleotides, polypeptides, antibodies, and/or agonists or antagonists of the present invention may also directly inhibit the infectious agent (refer to section of application listing infectious agents, etc), without necessarily eliciting an immune response.

[0531] In another embodiment, polypeptides, antibodies, polynucleotides and/or agonists or antagonists of the present invention are used as a vaccine adjuvant that enhances immune responsiveness to an antigen. In a specific embodiment, polypeptides, antibodies, polynucleotides and/or agonists or antagonists of the present invention are used as an adjuvant to enhance tumor-specific immune responses.

[0532] In another specific embodiment, polypeptides, antibodies, polynucleotides and/or agonists or antagonists of the present invention are used as an adjuvant to enhance anti-viral immune responses. Anti-viral immune responses that may be enhanced using the compositions of the invention as an adjuvant, include virus and virus associated diseases or symptoms described herein or otherwise known in the art. In specific embodiments, the compositions of the invention are used as an adjuvant to enhance an immune response to a virus, disease, or symptom selected from the group consisting of: AIDS, meningitis, Dengue, EBV, and hepatitis (e.g., hepatitis B). In another specific embodiment, the compositions of the invention are used as an adjuvant to enhance an immune response to a virus, disease, or symptom selected from the group consisting of: HIV/AIDS, respiratory syncytial virus, Dengue, rotavirus, Japanese B encephalitis, influenza A and B, parainfluenza, measles, cytomegalovirus, rabies, Junin, Chikungunya, Rift Valley Fever, herpes simplex, and yellow fever.

[0533] In another specific embodiment, polypeptides, antibodies, polynucleotides and/or agonists or antagonists of the present invention are used as an adjuvant to enhance anti-bacterial or anti-fungal immune responses. Anti-bacterial or anti-fungal immune responses that may be enhanced using the compositions of the invention as an adjuvant, include bacteria or fungus and bacteria or fungus associated diseases or symptoms described herein or otherwise known in the art. In specific embodiments, the compositions of the invention are used as an adjuvant to enhance an immune

response to a bacteria or fungus, disease, or symptom selected from the group consisting of: tetanus, Diphtheria, botulism, and meningitis type B.

[0534] In another specific embodiment, the compositions of the invention are used as an adjuvant to enhance an immune response to a bacteria or fungus, disease, or symptom selected from the group consisting of: *Vibrio cholerae*, *Mycobacterium leprae*, *Salmonella typhi*, *Salmonella paratyphi*, *Meisseria meningitidis*, *Streptococcus pneumoniae*, Group B streptococcus, *Shigella spp.*, Enterotoxigenic *Escherichia coli*, Enterohemorrhagic *E. coli*, and *Borrelia burgdorferi*.

[0535] In another specific embodiment, polypeptides, antibodies, polynucleotides and/or agonists or antagonists of the present invention are used as an adjuvant to enhance anti-parasitic immune responses. Anti-parasitic immune responses that may be enhanced using the compositions of the invention as an adjuvant, include parasite and parasite associated diseases or symptoms described herein or otherwise known in the art. In specific embodiments, the compositions of the invention are used as an adjuvant to enhance an immune response to a parasite. In another specific embodiment, the compositions of the invention are used as an adjuvant to enhance an immune response to Plasmodium (malaria) or Leishmania.

[0536] In another specific embodiment, polypeptides, antibodies, polynucleotides and/or agonists or antagonists of the present invention may also be employed to treat infectious diseases including silicosis, sarcoidosis, and idiopathic pulmonary fibrosis; for example, by preventing the recruitment and activation of mononuclear phagocytes.

[0537] In another specific embodiment, polypeptides, antibodies, polynucleotides and/or agonists or antagonists of the present invention are used as an antigen for the generation of antibodies to inhibit or enhance immune mediated responses against polypeptides of the invention.

[0538] In one embodiment, polypeptides, antibodies, polynucleotides and/or agonists or antagonists of the present invention are administered to an animal (e.g., mouse, rat, rabbit, hamster, guinea pig, pigs, micro-pig, chicken, camel, goat, horse, cow, sheep, dog, cat, non-human primate, and human, most preferably human) to boost the immune system to produce increased quantities of one or more antibodies (e.g., IgG, IgA, IgM, and IgE), to induce higher affinity antibody production and

immunoglobulin class switching (e.g., IgG, IgA, IgM, and IgE), and/or to increase an immune response.

[0539] In another specific embodiment, polypeptides, antibodies, polynucleotides and/or agonists or antagonists of the present invention are used as a stimulator of B cell responsiveness to pathogens.

[0540] In another specific embodiment, polypeptides, antibodies, polynucleotides and/or agonists or antagonists of the present invention are used as an activator of T cells.

[0541] In another specific embodiment, polypeptides, antibodies, polynucleotides and/or agonists or antagonists of the present invention are used as an agent that elevates the immune status of an individual prior to their receipt of immunosuppressive therapies.

[0542] In another specific embodiment, polypeptides, antibodies, polynucleotides and/or agonists or antagonists of the present invention are used as an agent to induce higher affinity antibodies.

[0543] In another specific embodiment, polypeptides, antibodies, polynucleotides and/or agonists or antagonists of the present invention are used as an agent to increase serum immunoglobulin concentrations.

[0544] In another specific embodiment, polypeptides, antibodies, polynucleotides and/or agonists or antagonists of the present invention are used as an agent to accelerate recovery of immunocompromised individuals.

[0545] In another specific embodiment, polypeptides, antibodies, polynucleotides and/or agonists or antagonists of the present invention are used as an agent to boost immunoresponsiveness among aged populations and/or neonates.

[0546] In another specific embodiment, polypeptides, antibodies, polynucleotides and/or agonists or antagonists of the present invention are used as an immune system enhancer prior to, during, or after bone marrow transplant and/or other transplants (e.g., allogeneic or xenogeneic organ transplantation). With respect to transplantation, compositions of the invention may be administered prior to, concomitant with, and/or after transplantation. In a specific embodiment, compositions of the invention are administered after transplantation, prior to the beginning of recovery of T-cell populations. In another specific embodiment, compositions of the invention are first

administered after transplantation after the beginning of recovery of T cell populations, but prior to full recovery of B cell populations.

[0547] In another specific embodiment, polypeptides, antibodies, polynucleotides and/or agonists or antagonists of the present invention are used as an agent to boost immunoresponsiveness among individuals having an acquired loss of B cell function. Conditions resulting in an acquired loss of B cell function that may be ameliorated or treated by administering the polypeptides, antibodies, polynucleotides and/or agonists or antagonists thereof, include, but are not limited to, HIV Infection, AIDS, bone marrow transplant, and B cell chronic lymphocytic leukemia (CLL).

[0548] In another specific embodiment, polypeptides, antibodies, polynucleotides and/or agonists or antagonists of the present invention are used as an agent to boost immunoresponsiveness among individuals having a temporary immune deficiency. Conditions resulting in a temporary immune deficiency that may be ameliorated or treated by administering the polypeptides, antibodies, polynucleotides and/or agonists or antagonists thereof, include, but are not limited to, recovery from viral infections (e.g., influenza), conditions associated with malnutrition, recovery from infectious mononucleosis, or conditions associated with stress, recovery from measles, recovery from blood transfusion, and recovery from surgery.

[0549] In another specific embodiment, polypeptides, antibodies, polynucleotides and/or agonists or antagonists of the present invention are used as a regulator of antigen presentation by monocytes, dendritic cells, and/or B-cells. In one embodiment, polynucleotides, polypeptides, antibodies, and/or agonists or antagonists of the present invention enhance antigen presentation or antagonizes antigen presentation in vitro or in vivo. Moreover, in related embodiments, said enhancement or antagonism of antigen presentation may be useful as an anti-tumor treatment or to modulate the immune system.

[0550] In another specific embodiment, polypeptides, antibodies, polynucleotides and/or agonists or antagonists of the present invention are used as an agent to direct an individual's immune system towards development of a humoral response (i.e. TH2) as opposed to a TH1 cellular response.

[0551] In another specific embodiment, polypeptides, antibodies, polynucleotides and/or agonists or antagonists of the present invention are used as a means to induce

tumor proliferation and thus make it more susceptible to anti-neoplastic agents. For example, multiple myeloma is a slowly dividing disease and is thus refractory to virtually all anti-neoplastic regimens. If these cells were forced to proliferate more rapidly their susceptibility profile would likely change.

[0552] In another specific embodiment, polypeptides, antibodies, polynucleotides and/or agonists or antagonists of the present invention are used as a stimulator of B cell production in pathologies such as AIDS, chronic lymphocyte disorder and/or Common Variable Immunodeficiency.

[0553] In another specific embodiment, polypeptides, antibodies, polynucleotides and/or agonists or antagonists of the present invention are used as a therapy for generation and/or regeneration of lymphoid tissues following surgery, trauma or genetic defect. In another specific embodiment, polypeptides, antibodies, polynucleotides and/or agonists or antagonists of the present invention are used in the pretreatment of bone marrow samples prior to transplant.

[0554] In another specific embodiment, polypeptides, antibodies, polynucleotides and/or agonists or antagonists of the present invention are used as a gene-based therapy for genetically inherited disorders resulting in immunoincompetence/immunodeficiency such as observed among SCID patients.

[0555] In another specific embodiment, polypeptides, antibodies, polynucleotides and/or agonists or antagonists of the present invention are used as a means of activating monocytes/macrophages to defend against parasitic diseases that effect monocytes such as Leishmania.

[0556] In another specific embodiment, polypeptides, antibodies, polynucleotides and/or agonists or antagonists of the present invention are used as a means of regulating secreted cytokines that are elicited by polypeptides of the invention.

[0557] In another embodiment, polypeptides, antibodies, polynucleotides and/or agonists or antagonists of the present invention are used in one or more of the applications described herein, as they may apply to veterinary medicine.

[0558] In another specific embodiment, polypeptides, antibodies, polynucleotides and/or agonists or antagonists of the present invention are used as a means of blocking various aspects of immune responses to foreign agents or self. Examples of diseases or conditions in which blocking of certain aspects of immune responses may be

desired include autoimmune disorders such as lupus, and arthritis, as well as immunoresponsiveness to skin allergies, inflammation, bowel disease, injury and diseases/disorders associated with pathogens.

[0559] In another specific embodiment, polypeptides, antibodies, polynucleotides and/or agonists or antagonists of the present invention are used as a therapy for preventing the B cell proliferation and Ig secretion associated with autoimmune diseases such as idiopathic thrombocytopenic purpura, systemic lupus erythematosus and multiple sclerosis.

[0560] In another specific embodiment, polypeptides, antibodies, polynucleotides and/or agonists or antagonists of the present invention are used as a inhibitor of B and/or T cell migration in endothelial cells. This activity disrupts tissue architecture or cognate responses and is useful, for example in disrupting immune responses, and blocking sepsis.

[0561] In another specific embodiment, polypeptides, antibodies, polynucleotides and/or agonists or antagonists of the present invention are used as a therapy for chronic hypergammaglobulinemia evident in such diseases as monoclonal gammopathy of undetermined significance (MGUS), Waldenstrom's disease, related idiopathic monoclonal gammopathies, and plasmacytomas.

[0562] In another specific embodiment, polypeptides, antibodies, polynucleotides and/or agonists or antagonists of the present invention may be employed for instance to inhibit polypeptide chemotaxis and activation of macrophages and their precursors, and of neutrophils, basophils, B lymphocytes and some T-cell subsets, e.g., activated and CD8 cytotoxic T cells and natural killer cells, in certain autoimmune and chronic inflammatory and infective diseases. Examples of autoimmune diseases are described herein and include multiple sclerosis, and insulin-dependent diabetes.

[0563] The polypeptides, antibodies, polynucleotides and/or agonists or antagonists of the present invention may also be employed to treat idiopathic hyper-eosinophilic syndrome by, for example, preventing eosinophil production and migration.

[0564] In another specific embodiment, polypeptides, antibodies, polynucleotides and/or agonists or antagonists of the present invention are used to enhance or inhibit complement mediated cell lysis.

- [0565] In another specific embodiment, polypeptides, antibodies, polynucleotides and/or agonists or antagonists of the present invention are used to enhance or inhibit antibody dependent cellular cytotoxicity.
- [0566] In another specific embodiment, polypeptides, antibodies, polynucleotides and/or agonists or antagonists of the present invention may also be employed for treating atherosclerosis, for example, by preventing monocyte infiltration in the artery wall.
- [0567] In another specific embodiment, polypeptides, antibodies, polynucleotides and/or agonists or antagonists of the present invention may be employed to treat adult respiratory distress syndrome (ARDS).
- [0568] In another specific embodiment, polypeptides, antibodies, polynucleotides and/or agonists or antagonists of the present invention may be useful for stimulating wound and tissue repair, stimulating angiogenesis, and/or stimulating the repair of vascular or lymphatic diseases or disorders. Additionally, agonists and antagonists of the invention may be used to stimulate the regeneration of mucosal surfaces.
- [0569] In a specific embodiment, polynucleotides or polypeptides, and/or agonists thereof are used to diagnose, prognose, treat, and/or prevent a disorder characterized by primary or acquired immunodeficiency, deficient serum immunoglobulin production, recurrent infections, and/or immune system dysfunction. Moreover, polynucleotides or polypeptides, and/or agonists thereof may be used to treat or prevent infections of the joints, bones, skin, and/or parotid glands, blood-borne infections (e.g., sepsis, meningitis, septic arthritis, and/or osteomyelitis), autoimmune diseases (e.g., those disclosed herein), inflammatory disorders, and malignancies, and/or any disease or disorder or condition associated with these infections, diseases, disorders and/or malignancies) including, but not limited to, CVID, other primary immune deficiencies, HIV disease, CLL, recurrent bronchitis, sinusitis, otitis media, conjunctivitis, pneumonia, hepatitis, meningitis, herpes zoster (e.g., severe herpes zoster), and/or pneumocystis carinii. Other diseases and disorders that may be prevented, diagnosed, prognosed, and/or treated with polynucleotides or polypeptides, and/or agonists of the present invention include, but are not limited to, HIV infection, HTLV-BLV infection, lymphopenia, phagocyte bactericidal dysfunction anemia, thrombocytopenia, and hemoglobinuria.

- [0570] In another embodiment, polynucleotides, polypeptides, antibodies, and/or agonists or antagonists of the present invention are used to treat, and/or diagnose an individual having common variable immunodeficiency disease ("CVID"; also known as "acquired agammaglobulinemia" and "acquired hypogammaglobulinemia") or a subset of this disease.
- [0571] In a specific embodiment, polynucleotides, polypeptides, antibodies, and/or agonists or antagonists of the present invention may be used to diagnose, prognose, prevent, and/or treat cancers or neoplasms including immune cell or immune tissue-related cancers or neoplasms. Examples of cancers or neoplasms that may be prevented, diagnosed, or treated by polynucleotides, polypeptides, antibodies, and/or agonists or antagonists of the present invention include, but are not limited to, acute myelogenous leukemia, chronic myelogenous leukemia, Hodgkin's disease, non-Hodgkin's lymphoma, acute lymphocytic anemia (ALL) Chronic lymphocyte leukemia, plasmacytomas, multiple myeloma, Burkitt's lymphoma, EBV-transformed diseases, and/or diseases and disorders described in the section entitled "Hyperproliferative Disorders" elsewhere herein.
- [0572] In another specific embodiment, polypeptides, antibodies, polynucleotides and/or agonists or antagonists of the present invention are used as a therapy for decreasing cellular proliferation of Large B-cell Lymphomas.
- [0573] In another specific embodiment, polypeptides, antibodies, polynucleotides and/or agonists or antagonists of the present invention are used as a means of decreasing the involvement of B cells and Ig associated with Chronic Myelogenous Leukemia.
- [0574] In specific embodiments, the compositions of the invention are used as an agent to boost immunoresponsiveness among B cell immunodeficient individuals, such as, for example, an individual who has undergone a partial or complete splenectomy.
- [0575] Antagonists of the invention include, for example, binding and/or inhibitory antibodies, antisense nucleic acids, ribozymes or soluble forms of the polypeptides of the present invention (e.g., Fc fusion protein; see, e.g., Example 9). Agonists of the invention include, for example, binding or stimulatory antibodies, and soluble forms of the polypeptides (e.g., Fc fusion proteins; see, e.g., Example 9).

Polypeptides, antibodies, polynucleotides and/or agonists or antagonists of the present invention may be employed in a composition with a pharmaceutically acceptable carrier, e.g., as described herein.

[0576] In another embodiment, polypeptides, antibodies, polynucleotides and/or agonists or antagonists of the present invention are administered to an animal (including, but not limited to, those listed above, and also including transgenic animals) incapable of producing functional endogenous antibody molecules or having an otherwise compromised endogenous immune system, but which is capable of producing human immunoglobulin molecules by means of a reconstituted or partially reconstituted immune system from another animal (see, e.g., published PCT Application Nos. WO98/24893, WO/9634096, WO/9633735, and WO/9110741). Administration of polypeptides, antibodies, polynucleotides and/or agonists or antagonists of the present invention to such animals is useful for the generation of monoclonal antibodies against the polypeptides, antibodies, polynucleotides and/or agonists or antagonists of the present invention.

Blood-Related Disorders

[0577] The polynucleotides, polypeptides, antibodies, and/or agonists or antagonists of the present invention may be used to modulate hemostatic (the stopping of bleeding) or thrombolytic (clot dissolving) activity. For example, by increasing hemostatic or thrombolytic activity, polynucleotides or polypeptides, and/or agonists or antagonists of the present invention could be used to treat or prevent blood coagulation diseases, disorders, and/or conditions (e.g., afibrinogenemia, factor deficiencies, hemophilia), blood platelet diseases, disorders, and/or conditions (e.g., thrombocytopenia), or wounds resulting from trauma, surgery, or other causes. Alternatively, polynucleotides, polypeptides, antibodies, and/or agonists or antagonists of the present invention that can decrease hemostatic or thrombolytic activity could be used to inhibit or dissolve clotting. These molecules could be important in the treatment or prevention of heart attacks (infarction), strokes, or scarring.

[0578] In specific embodiments, the polynucleotides, polypeptides, antibodies, and/or agonists or antagonists of the present invention may be used to prevent, diagnose, prognose, and/or treat thrombosis, arterial thrombosis, venous thrombosis,

thromboembolism, pulmonary embolism, atherosclerosis, myocardial infarction, transient ischemic attack, unstable angina. In specific embodiments, the polynucleotides, polypeptides, antibodies, and/or agonists or antagonists of the present invention may be used for the prevention of occlusion of saphenous grafts, for reducing the risk of periprocedural thrombosis as might accompany angioplasty procedures, for reducing the risk of stroke in patients with atrial fibrillation including nonrheumatic atrial fibrillation, for reducing the risk of embolism associated with mechanical heart valves and or mitral valves disease. Other uses for the polynucleotides, polypeptides, antibodies, and/or agonists or antagonists of the present invention, include, but are not limited to, the prevention of occlusions in extracorporeal devices (e.g., intravascular canulas, vascular access shunts in hemodialysis patients, hemodialysis machines, and cardiopulmonary bypass machines).

[0579] In another embodiment, a polypeptide of the invention, or polynucleotides, antibodies, agonists, or antagonists corresponding to that polypeptide, may be used to prevent, diagnose, prognose, and/or treat diseases and disorders of the blood and/or blood forming organs associated with the tissue(s) in which the polypeptide of the invention is expressed, including one, two, three, four, five, or more tissues disclosed in Table 1A, column 7 (Tissue Distribution Library Code).

[0580] The polynucleotides, polypeptides, antibodies, and/or agonists or antagonists of the present invention may be used to modulate hematopoietic activity (the formation of blood cells). For example, the polynucleotides, polypeptides, antibodies, and/or agonists or antagonists of the present invention may be used to increase the quantity of all or subsets of blood cells, such as, for example, erythrocytes, lymphocytes (B or T cells), myeloid cells (e.g., basophils, eosinophils, neutrophils, mast cells, macrophages) and platelets. The ability to decrease the quantity of blood cells or subsets of blood cells may be useful in the prevention, detection, diagnosis and/or treatment of anemias and leukopenias described below. Alternatively, the polynucleotides, polypeptides, antibodies, and/or agonists or antagonists of the present invention may be used to decrease the quantity of all or subsets of blood cells, such as, for example, erythrocytes, lymphocytes (B or T cells), myeloid cells (e.g., basophils, eosinophils, neutrophils, mast cells, macrophages) and platelets. The ability to decrease the quantity of blood cells or subsets of blood cells

may be useful in the prevention, detection, diagnosis and/or treatment of leukocytoses, such as, for example eosinophilia.

[0581] The polynucleotides, polypeptides, antibodies, and/or agonists or antagonists of the present invention may be used to prevent, treat, or diagnose blood dyscrasia.

[0582] Anemias are conditions in which the number of red blood cells or amount of hemoglobin (the protein that carries oxygen) in them is below normal. Anemia may be caused by excessive bleeding, decreased red blood cell production, or increased red blood cell destruction (hemolysis). The polynucleotides, polypeptides, antibodies, and/or agonists or antagonists of the present invention may be useful in treating, preventing, and/or diagnosing anemias. Anemias that may be treated prevented or diagnosed by the polynucleotides, polypeptides, antibodies, and/or agonists or antagonists of the present invention include iron deficiency anemia, hypochromic anemia, microcytic anemia, chlorosis, hereditary sideroblastic anemia, idiopathic acquired sideroblastic anemia, red cell aplasia, megaloblastic anemia (e.g., pernicious anemia, (vitamin B12 deficiency) and folic acid deficiency anemia), aplastic anemia, hemolytic anemias (e.g., autoimmune hemolytic anemia, microangiopathic hemolytic anemia, and paroxysmal nocturnal hemoglobinuria). The polynucleotides, polypeptides, antibodies, and/or agonists or antagonists of the present invention may be useful in treating, preventing, and/or diagnosing anemias associated with diseases including but not limited to, anemias associated with systemic lupus erythematosus, cancers, lymphomas, chronic renal disease, and enlarged spleens. The polynucleotides, polypeptides, antibodies, and/or agonists or antagonists of the present invention may be useful in treating, preventing, and/or diagnosing anemias arising from drug treatments such as anemias associated with methyldopa, dapsone, and/or sulfadruugs. Additionally, the polynucleotides, polypeptides, antibodies, and/or agonists or antagonists of the present invention may be useful in treating, preventing, and/or diagnosing anemias associated with abnormal red blood cell architecture including but not limited to, hereditary spherocytosis, hereditary elliptocytosis, glucose-6-phosphate dehydrogenase deficiency, and sickle cell anemia.

[0583] The polynucleotides, polypeptides, antibodies, and/or agonists or antagonists of the present invention may be useful in treating, preventing, and/or

diagnosing hemoglobin abnormalities, (e.g., those associated with sickle cell anemia, hemoglobin C disease, hemoglobin S-C disease, and hemoglobin E disease). Additionally, the polynucleotides, polypeptides, antibodies, and/or agonists or antagonists of the present invention may be useful in diagnosing, prognosing, preventing, and/or treating thalassemias, including, but not limited to major and minor forms of alpha-thalassemia and beta-thalassemia.

[0584] In another embodiment, the polynucleotides, polypeptides, antibodies, and/or agonists or antagonists of the present invention may be useful in diagnosing, prognosing, preventing, and/or treating bleeding disorders including, but not limited to, thrombocytopenia (e.g., idiopathic thrombocytopenic purpura, and thrombotic thrombocytopenic purpura), Von Willebrand's disease, hereditary platelet disorders (e.g., storage pool disease such as Chediak-Higashi and Hermansky-Pudlak syndromes, thromboxane A2 dysfunction, thromboasthenia, and Bernard-Soulier syndrome), hemolytic-uremic syndrome, hemophelias such as hemophilia A or Factor VII deficiency and Christmas disease or Factor IX deficiency, Hereditary Hemorrhagic Telangiectasia, also known as Rendu-Osler-Weber syndrome, allergic purpura (Henoch Schonlein purpura) and disseminated intravascular coagulation.

[0585] The effect of the polynucleotides, polypeptides, antibodies, and/or agonists or antagonists of the present invention on the clotting time of blood may be monitored using any of the clotting tests known in the art including, but not limited to, whole blood partial thromboplastin time (PTT), the activated partial thromboplastin time (aPTT), the activated clotting time (ACT), the recalcified activated clotting time, or the Lee-White Clotting time.

[0586] Several diseases and a variety of drugs can cause platelet dysfunction. Thus, in a specific embodiment, the polynucleotides, polypeptides, antibodies, and/or agonists or antagonists of the present invention may be useful in diagnosing, prognosing, preventing, and/or treating acquired platelet dysfunction such as platelet dysfunction accompanying kidney failure, leukemia, multiple myeloma, cirrhosis of the liver, and systemic lupus erythematosus as well as platelet dysfunction associated with drug treatments, including treatment with aspirin, ticlopidine, nonsteroidal anti-inflammatory drugs (used for arthritis, pain, and sprains), and penicillin in high doses.

[0587] In another embodiment, the polynucleotides, polypeptides, antibodies, and/or agonists or antagonists of the present invention may be useful in diagnosing, prognosing, preventing, and/or treating diseases and disorders characterized by or associated with increased or decreased numbers of white blood cells. Leukopenia occurs when the number of white blood cells decreases below normal. Leukopenias include, but are not limited to, neutropenia and lymphocytopenia. An increase in the number of white blood cells compared to normal is known as leukocytosis. The body generates increased numbers of white blood cells during infection. Thus, leukocytosis may simply be a normal physiological parameter that reflects infection. Alternatively, leukocytosis may be an indicator of injury or other disease such as cancer. Leukocytoses, include but are not limited to, eosinophilia, and accumulations of macrophages. In specific embodiments, the polynucleotides, polypeptides, antibodies, and/or agonists or antagonists of the present invention may be useful in diagnosing, prognosing, preventing, and/or treating leukopenia. In other specific embodiments, the polynucleotides, polypeptides, antibodies, and/or agonists or antagonists of the present invention may be useful in diagnosing, prognosing, preventing, and/or treating leukocytosis.

[0588] Leukopenia may be a generalized decrease in all types of white blood cells, or may be a specific depletion of particular types of white blood cells. Thus, in specific embodiments, the polynucleotides, polypeptides, antibodies, and/or agonists or antagonists of the present invention may be useful in diagnosing, prognosing, preventing, and/or treating decreases in neutrophil numbers, known as neutropenia. Neutropenias that may be diagnosed, prognosed, prevented, and/or treated by the polynucleotides, polypeptides, antibodies, and/or agonists or antagonists of the present invention include, but are not limited to, infantile genetic agranulocytosis, familial neutropenia, cyclic neutropenia, neutropenias resulting from or associated with dietary deficiencies (e.g., vitamin B 12 deficiency or folic acid deficiency), neutropenias resulting from or associated with drug treatments (e.g., antibiotic regimens such as penicillin treatment, sulfonamide treatment, anticoagulant treatment, anticonvulsant drugs, anti-thyroid drugs, and cancer chemotherapy), and neutropenias resulting from increased neutrophil destruction that may occur in association with some bacterial or viral infections, allergic disorders, autoimmune diseases, conditions in which an

individual has an enlarged spleen (e.g., Felty syndrome, malaria and sarcoidosis), and some drug treatment regimens.

[0589] The polynucleotides, polypeptides, antibodies, and/or agonists or antagonists of the present invention may be useful in diagnosing, prognosing, preventing, and/or treating lymphocytopenias (decreased numbers of B and/or T lymphocytes), including, but not limited to lymphocytopenias resulting from or associated with stress, drug treatments (e.g., drug treatment with corticosteroids, cancer chemotherapies, and/or radiation therapies), AIDS infection and/or other diseases such as, for example, cancer, rheumatoid arthritis, systemic lupus erythematosus, chronic infections, some viral infections and/or hereditary disorders (e.g., DiGeorge syndrome, Wiskott-Aldrich Syndrome, severe combined immunodeficiency, ataxia telangiectasia).

[0590] The polynucleotides, polypeptides, antibodies, and/or agonists or antagonists of the present invention may be useful in diagnosing, prognosing, preventing, and/or treating diseases and disorders associated with macrophage numbers and/or macrophage function including, but not limited to, Gaucher's disease, Niemann-Pick disease, Letterer-Siwe disease and Hand-Schuller-Christian disease.

[0591] In another embodiment, the polynucleotides, polypeptides, antibodies, and/or agonists or antagonists of the present invention may be useful in diagnosing, prognosing, preventing, and/or treating diseases and disorders associated with eosinophil numbers and/or eosinophil function including, but not limited to, idiopathic hypereosinophilic syndrome, eosinophilia-myalgia syndrome, and Hand-Schuller-Christian disease.

[0592] In yet another embodiment, the polynucleotides, polypeptides, antibodies, and/or agonists or antagonists of the present invention may be useful in diagnosing, prognosing, preventing, and/or treating leukemias and lymphomas including, but not limited to, acute lymphocytic (lymphoblastic) leukemia (ALL), acute myeloid (myelocytic, myelogenous, myeloblastic, or myelomonocytic) leukemia, chronic lymphocytic leukemia (e.g., B cell leukemias, T cell leukemias, Sezary syndrome, and Hairy cell leukemia), chronic myelocytic (myeloid, myelogenous, or granulocytic) leukemia, Hodgkin's lymphoma, non-hodgkin's lymphoma, Burkitt's lymphoma, and mycosis fungoides.

- [0593] In other embodiments, the polynucleotides, polypeptides, antibodies, and/or agonists or antagonists of the present invention may be useful in diagnosing, prognosing, preventing, and/or treating diseases and disorders of plasma cells including, but not limited to, plasma cell dyscrasias, monoclonal gammaopathies, monoclonal gammopathies of undetermined significance, multiple myeloma, macroglobulinemia, Waldenstrom's macroglobulinemia, cryoglobulinemia, and Raynaud's phenomenon.
- [0594] In other embodiments, the polynucleotides, polypeptides, antibodies, and/or agonists or antagonists of the present invention may be useful in treating, preventing, and/or diagnosing myeloproliferative disorders, including but not limited to, polycythemia vera, relative polycythemia, secondary polycythemia, myelofibrosis, acute myelofibrosis, agnogenic myeloid metaplasia, thrombocythemia, (including both primary and secondary thrombocythemia) and chronic myelocytic leukemia.
- [0595] In other embodiments, the polynucleotides, polypeptides, antibodies, and/or agonists or antagonists of the present invention may be useful as a treatment prior to surgery, to increase blood cell production.
- [0596] In other embodiments, the polynucleotides, polypeptides, antibodies, and/or agonists or antagonists of the present invention may be useful as an agent to enhance the migration, phagocytosis, superoxide production, antibody dependent cellular cytotoxicity of neutrophils, eosinophils and macrophages.
- [0597] In other embodiments, the polynucleotides, polypeptides, antibodies, and/or agonists or antagonists of the present invention may be useful as an agent to increase the number of stem cells in circulation prior to stem cells pheresis. In another specific embodiment, the polynucleotides, polypeptides, antibodies, and/or agonists or antagonists of the present invention may be useful as an agent to increase the number of stem cells in circulation prior to platelet pheresis.
- [0598] In other embodiments, the polynucleotides, polypeptides, antibodies, and/or agonists or antagonists of the present invention may be useful as an agent to increase cytokine production.
- [0599] In other embodiments, the polynucleotides, polypeptides, antibodies, and/or agonists or antagonists of the present invention may be useful in preventing, diagnosing, and/or treating primary hematopoietic disorders.

Hyperproliferative Disorders

[0600] Reproductive system associated polynucleotides or polypeptides, or agonists or antagonists thereof, can be used to treat, prevent, diagnose and/or prognose hyperproliferative diseases, disorders, and/or conditions, including neoplasms.

[0601] In a specific embodiment, reproductive system associated polynucleotides or polypeptides, or agonists or antagonists thereof, can be used to treat, prevent, and/or diagnose hyperproliferative diseases, disorders, and/or conditions of the reproductive system.

[0602] In a preferred embodiment, reproductive system associated polynucleotides or polypeptides, or agonists or antagonists thereof, can be used to treat, prevent, and/or diagnose reproductive system neoplasms.

[0603] Reproductive system associated polynucleotides or polypeptides, or agonists or antagonists of the invention, may inhibit the proliferation of the disorder through direct or indirect interactions. Alternatively, reproductive system associated polynucleotides or polypeptides, or agonists or antagonists thereof, may proliferate other cells, which can inhibit the hyperproliferative disorder.

[0604] For example, by increasing an immune response, particularly increasing antigenic qualities of the hyperproliferative disorder or by proliferating, differentiating, or mobilizing T-cells, hyperproliferative diseases, disorders, and/or conditions can be treated, prevented, and/or diagnosed. This immune response may be increased by either enhancing an existing immune response, or by initiating a new immune response. Alternatively, decreasing an immune response may also be a method of treating, preventing, and/or diagnosing hyperproliferative diseases, disorders, and/or conditions, such as a chemotherapeutic agent.

[0605] Examples of hyperproliferative diseases, disorders, and/or conditions that can be treated, prevented, and/or diagnosed by reproductive system associated polynucleotides or polypeptides, or agonists or antagonists thereof, include, but are not limited to neoplasms located in the: prostate, colon, abdomen, bone, breast, digestive system, liver, pancreas, peritoneum, endocrine glands (adrenal, parathyroid, pituitary, testicles, ovary, thymus, thyroid), eye, head and neck, nervous (central and peripheral), lymphatic system, pelvic, skin, soft tissue, spleen, thoracic, and urogenital.

[0606] Similarly, other hyperproliferative disorders can also be treated or detected by polynucleotides or polypeptides, or agonists or antagonists of the present invention. Examples of such hyperproliferative disorders include, but are not limited to: Acute Childhood Lymphoblastic Leukemia, Acute Lymphoblastic Leukemia, Acute Lymphocytic Leukemia, Acute Myeloid Leukemia, Adrenocortical Carcinoma, Adult (Primary) Hepatocellular Cancer, Adult (Primary) Liver Cancer, Adult Acute Lymphocytic Leukemia, Adult Acute Myeloid Leukemia, Adult Hodgkin's Disease, Adult Hodgkin's Lymphoma, Adult Lymphocytic Leukemia, Adult Non-Hodgkin's Lymphoma, Adult Primary Liver Cancer, Adult Soft Tissue Sarcoma, AIDS-Related Lymphoma, AIDS-Related Malignancies, Anal Cancer, Astrocytoma, Bile Duct Cancer, Bladder Cancer, Bone Cancer, Brain Stem Glioma, Brain Tumors, Breast Cancer, Cancer of the Renal Pelvis and Ureter, Central Nervous System (Primary) Lymphoma, Central Nervous System Lymphoma, Cerebellar Astrocytoma, Cerebral Astrocytoma, Cervical Cancer, Childhood (Primary) Hepatocellular Cancer, Childhood (Primary) Liver Cancer, Childhood Acute Lymphoblastic Leukemia, Childhood Acute Myeloid Leukemia, Childhood Brain Stem Glioma, Childhood Cerebellar Astrocytoma, Childhood Cerebral Astrocytoma, Childhood Extracranial Germ Cell Tumors, Childhood Hodgkin's Disease, Childhood Hodgkin's Lymphoma, Childhood Hypothalamic and Visual Pathway Glioma, Childhood Lymphoblastic Leukemia, Childhood Medulloblastoma, Childhood Non-Hodgkin's Lymphoma, Childhood Pineal and Supratentorial Primitive Neuroectodermal Tumors, Childhood Primary Liver Cancer, Childhood Rhabdomyosarcoma, Childhood Soft Tissue Sarcoma, Childhood Visual Pathway and Hypothalamic Glioma, Chronic Lymphocytic Leukemia, Chronic Myelogenous Leukemia, Colon Cancer, Cutaneous T-Cell Lymphoma, Endocrine Pancreas Islet Cell Carcinoma, Endometrial Cancer, Ependymoma, Epithelial Cancer, Esophageal Cancer, Ewing's Sarcoma and Related Tumors, Exocrine Pancreatic Cancer, Extracranial Germ Cell Tumor, Extragonadal Germ Cell Tumor, Extrahepatic Bile Duct Cancer, Eye Cancer, Female Breast Cancer, Gaucher's Disease, Gallbladder Cancer, Gastric Cancer, Gastrointestinal Carcinoid Tumor, Gastrointestinal Tumors, Germ Cell Tumors, Gestational Trophoblastic Tumor, Hairy Cell Leukemia, Head and Neck Cancer, Hepatocellular Cancer, Hodgkin's Disease, Hodgkin's Lymphoma, Hypergammaglobulinemia,

Hypopharyngeal Cancer, Intestinal Cancers, Intraocular Melanoma, Islet Cell Carcinoma, Islet Cell Pancreatic Cancer, Kaposi's Sarcoma, Kidney Cancer, Laryngeal Cancer, Lip and Oral Cavity Cancer, Liver Cancer, Lung Cancer, Lymphoproliferative Disorders, Macroglobulinemia, Male Breast Cancer, Malignant Mesothelioma, Malignant Thymoma, Medulloblastoma, Melanoma, Mesothelioma, Metastatic Occult Primary Squamous Neck Cancer, Metastatic Primary Squamous Neck Cancer, Metastatic Squamous Neck Cancer, Multiple Myeloma, Multiple Myeloma/Plasma Cell Neoplasm, Myelodysplastic Syndrome, Myelogenous Leukemia, Myeloid Leukemia, Myeloproliferative Disorders, Nasal Cavity and Paranasal Sinus Cancer, Nasopharyngeal Cancer, Neuroblastoma, Non-Hodgkin's Lymphoma During Pregnancy, Nonmelanoma Skin Cancer, Non-Small Cell Lung Cancer, Occult Primary Metastatic Squamous Neck Cancer, Oropharyngeal Cancer, Osteo-/Malignant Fibrous Sarcoma, Osteosarcoma/Malignant Fibrous Histiocytoma, Osteosarcoma/Malignant Fibrous Histiocytoma of Bone, Ovarian Epithelial Cancer, Ovarian Germ Cell Tumor, Ovarian Low Malignant Potential Tumor, Pancreatic Cancer, Paraproteinemia, Purpura, Parathyroid Cancer, Penile Cancer, Pheochromocytoma, Pituitary Tumor, Plasma Cell Neoplasm/Multiple Myeloma, Primary Central Nervous System Lymphoma, Primary Liver Cancer, Prostate Cancer, Rectal Cancer, Renal Cell Cancer, Renal Pelvis and Ureter Cancer, Retinoblastoma, Rhabdomyosarcoma, Salivary Gland Cancer, Sarcoidosis Sarcomas, Sezary Syndrome, Skin Cancer, Small Cell Lung Cancer, Small Intestine Cancer, Soft Tissue Sarcoma, Squamous Neck Cancer, Stomach Cancer, Supratentorial Primitive Neuroectodermal and Pineal Tumors, T-Cell Lymphoma, Testicular Cancer, Thymoma, Thyroid Cancer, Transitional Cell Cancer of the Renal Pelvis and Ureter, Transitional Renal Pelvis and Ureter Cancer, Trophoblastic Tumors, Ureter and Renal Pelvis Cell Cancer, Urethral Cancer, Uterine Cancer, Uterine Sarcoma, Vaginal Cancer, Visual Pathway and Hypothalamic Glioma, Vulvar Cancer, Waldenstrom's Macroglobulinemia, Wilms' Tumor, and any other hyperproliferative disease, besides neoplasia, located in an organ system listed above.

[0607] In another preferred embodiment, polynucleotides or polypeptides, or agonists or antagonists of the present invention are used to diagnose, prognose, prevent, and/or treat premalignant conditions and to prevent progression to a neoplastic or malignant state, including but not limited to those disorders described

above. Such uses are indicated in conditions known or suspected of preceding progression to neoplasia or cancer, in particular, where non-neoplastic cell growth consisting of hyperplasia, metaplasia, or most particularly, dysplasia has occurred (for review of such abnormal growth conditions, see Robbins and Angell, 1976, Basic Pathology, 2d Ed., W. B. Saunders Co., Philadelphia, pp. 68-79.)

[0608] Hyperplasia is a form of controlled cell proliferation, involving an increase in cell number in a tissue or organ, without significant alteration in structure or function. Hyperplastic disorders which can be diagnosed, prognosed, prevented, and/or treated with compositions of the invention (including polynucleotides, polypeptides, agonists or antagonists) include, but are not limited to, angiofollicular mediastinal lymph node hyperplasia, angiolymphoid hyperplasia with eosinophilia, atypical melanocytic hyperplasia, basal cell hyperplasia, benign giant lymph node hyperplasia, cementum hyperplasia, congenital adrenal hyperplasia, congenital sebaceous hyperplasia, cystic hyperplasia, cystic hyperplasia of the breast, denture hyperplasia, ductal hyperplasia, endometrial hyperplasia, fibromuscular hyperplasia, focal epithelial hyperplasia, gingival hyperplasia, inflammatory fibrous hyperplasia, inflammatory papillary hyperplasia, intravascular papillary endothelial hyperplasia, nodular hyperplasia of prostate, nodular regenerative hyperplasia, pseudoepitheliomatous hyperplasia, senile sebaceous hyperplasia, and verrucous hyperplasia.

[0609] Metaplasia is a form of controlled cell growth in which one type of adult or fully differentiated cell substitutes for another type of adult cell. Metaplastic disorders which can be diagnosed, prognosed, prevented, and/or treated with compositions of the invention (including polynucleotides, polypeptides, agonists or antagonists) include, but are not limited to, agnogenic myeloid metaplasia, apocrine metaplasia, atypical metaplasia, autoparenchymatous metaplasia, connective tissue metaplasia, epithelial metaplasia, intestinal metaplasia, metaplastic anemia, metaplastic ossification, metaplastic polyps, myeloid metaplasia, primary myeloid metaplasia, secondary myeloid metaplasia, squamous metaplasia, squamous metaplasia of amnion, and symptomatic myeloid metaplasia.

[0610] Dysplasia is frequently a forerunner of cancer, and is found mainly in the epithelia; it is the most disorderly form of non-neoplastic cell growth, involving a loss

in individual cell uniformity and in the architectural orientation of cells. Dysplastic cells often have abnormally large, deeply stained nuclei, and exhibit pleomorphism. Dysplasia characteristically occurs where there exists chronic irritation or inflammation. Dysplastic disorders which can be diagnosed, prognosed, prevented, and/or treated with compositions of the invention (including polynucleotides, polypeptides, agonists or antagonists) include, but are not limited to, anhidrotic ectodermal dysplasia, anterofacial dysplasia, asphyxiating thoracic dysplasia, atriadigital dysplasia, bronchopulmonary dysplasia, cerebral dysplasia, cervical dysplasia, chondroectodermal dysplasia, cleidocranial dysplasia, congenital ectodermal dysplasia, craniodiaphysial dysplasia, craniocarpotarsal dysplasia, craniometaphysial dysplasia, dentin dysplasia, diaphysial dysplasia, ectodermal dysplasia, enamel dysplasia, encephalo-ophthalmic dysplasia, dysplasia epiphysialis hemimelia, dysplasia epiphysialis multiplex, dysplasia epiphysialis punctata, epithelial dysplasia, faciodeligitogenital dysplasia, familial fibrous dysplasia of jaws, familial white folded dysplasia, fibromuscular dysplasia, fibrous dysplasia of bone, florid osseous dysplasia, hereditary renal-retinal dysplasia, hidrotic ectodermal dysplasia, hypohidrotic ectodermal dysplasia, lymphopenic thymic dysplasia, mammary dysplasia, mandibulofacial dysplasia, metaphysial dysplasia, Mondini dysplasia, monostotic fibrous dysplasia, mucoepithelial dysplasia, multiple epiphysial dysplasia, oculoauriculovertebral dysplasia, oculodentodigital dysplasia, oculovertbral dysplasia, odontogenic dysplasia, ophthalmomandibulomelic dysplasia, periapical cemental dysplasia, polyostotic fibrous dysplasia, pseudoachondroplastic spondyloepiphysial dysplasia, retinal dysplasia, septo-optic dysplasia, spondyloepiphysial dysplasia, and ventriculoradial dysplasia.

[0611] Additional pre-neoplastic disorders which can be diagnosed, prognosed, prevented, and/or treated with compositions of the invention (including polynucleotides, polypeptides, agonists or antagonists) include, but are not limited to, benign dysproliferative disorders (e.g., benign tumors, fibrocystic conditions, tissue hypertrophy, intestinal polyps, colon polyps, and esophageal dysplasia), leukoplakia, keratoses, Bowen's disease, Farmer's Skin, solar cheilitis, and solar keratosis.

[0612] In another embodiment, a polypeptide of the invention, or polynucleotides, antibodies, agonists, or antagonists corresponding to that polypeptide, may be used to

diagnose and/or prognose disorders associated with the tissue(s) in which the polypeptide of the invention is expressed, including one, two, three, four, five, or more tissues disclosed in Table 1A, 7 (Tissue Distribution Library Code).

[0613] In another embodiment, polynucleotides, polypeptides, antibodies, and/or agonists or antagonists of the present invention conjugated to a toxin or a radioactive isotope, as described herein, may be used to treat cancers and neoplasms, including, but not limited to those described herein. In a further preferred embodiment, polynucleotides, polypeptides, antibodies, and/or agonists or antagonists of the present invention conjugated to a toxin or a radioactive isotope, as described herein, may be used to treat acute myelogenous leukemia.

[0614] Additionally, polynucleotides, polypeptides, and/or agonists or antagonists of the invention may affect apoptosis, and therefore, would be useful in treating a number of diseases associated with increased cell survival or the inhibition of apoptosis. For example, diseases associated with increased cell survival or the inhibition of apoptosis that could be diagnosed, prognosed, prevented, and/or treated by polynucleotides, polypeptides, and/or agonists or antagonists of the invention, include cancers (such as follicular lymphomas, carcinomas with p53 mutations, and hormone-dependent tumors, including, but not limited to colon cancer, cardiac tumors, pancreatic cancer, melanoma, retinoblastoma, glioblastoma, lung cancer, intestinal cancer, testicular cancer, stomach cancer, neuroblastoma, myxoma, myoma, lymphoma, endothelioma, osteoblastoma, osteoclastoma, osteosarcoma, chondrosarcoma, adenoma, breast cancer, prostate cancer, Kaposi's sarcoma and ovarian cancer); autoimmune disorders such as, multiple sclerosis, Sjogren's syndrome, Hashimoto's thyroiditis, biliary cirrhosis, Behcet's disease, Crohn's disease, polymyositis, systemic lupus erythematosus and immune-related glomerulonephritis and rheumatoid arthritis) and viral infections (such as herpes viruses, pox viruses and adenoviruses), inflammation, graft v. host disease, acute graft rejection, and chronic graft rejection.

[0615] In preferred embodiments, polynucleotides, polypeptides, and/or agonists or antagonists of the invention are used to inhibit growth, progression, and/or metastasis of cancers, in particular those listed above.

[0616] Additional diseases or conditions associated with increased cell survival that could be diagnosed, prognosed, prevented, and/or treated by polynucleotides, polypeptides, and/or agonists or antagonists of the invention, include, but are not limited to, progression, and/or metastases of malignancies and related disorders such as leukemia (including acute leukemias (e.g., acute lymphocytic leukemia, acute myelocytic leukemia (including myeloblastic, promyelocytic, myelomonocytic, monocytic, and erythroleukemia)) and chronic leukemias (e.g., chronic myelocytic (granulocytic) leukemia and chronic lymphocytic leukemia)), polycythemia vera, lymphomas (e.g., Hodgkin's disease and non-Hodgkin's disease), multiple myeloma, Waldenstrom's macroglobulinemia, heavy chain disease, and solid tumors including, but not limited to, sarcomas and carcinomas such as fibrosarcoma, myxosarcoma, liposarcoma, chondrosarcoma, osteogenic sarcoma, chordoma, angiosarcoma, endotheliosarcoma, lymphangiosarcoma, lymphangioendotheliosarcoma, synovioma, mesothelioma, Ewing's tumor, leiomyosarcoma, rhabdomyosarcoma, colon carcinoma, pancreatic cancer, breast cancer, ovarian cancer, prostate cancer, squamous cell carcinoma, basal cell carcinoma, adenocarcinoma, sweat gland carcinoma, sebaceous gland carcinoma, papillary carcinoma, papillary adenocarcinomas, cystadenocarcinoma, medullary carcinoma, bronchogenic carcinoma, renal cell carcinoma, hepatoma, bile duct carcinoma, choriocarcinoma, seminoma, embryonal carcinoma, Wilm's tumor, cervical cancer, testicular tumor, lung carcinoma, small cell lung carcinoma, bladder carcinoma, epithelial carcinoma, glioma, astrocytoma, medulloblastoma, craniopharyngioma, ependymoma, pinealoma, emangioblastoma, acoustic neuroma, oligodendroglioma, menangioma, melanoma, neuroblastoma, and retinoblastoma.

[0617] Diseases associated with increased apoptosis that could be diagnosed, prognosed, prevented, and/or treated by polynucleotides, polypeptides, and/or agonists or antagonists of the invention, include AIDS; neurodegenerative disorders (such as Alzheimer's disease, Parkinson's disease, amyotrophic lateral sclerosis, retinitis pigmentosa, cerebellar degeneration and brain tumor or prior associated disease); autoimmune disorders (such as, multiple sclerosis, Sjogren's syndrome, Hashimoto's thyroiditis, biliary cirrhosis, Behcet's disease, Crohn's disease, polymyositis, systemic lupus erythematosus and immune-related glomerulonephritis and rheumatoid arthritis)

myelodysplastic syndromes (such as aplastic anemia), graft v. host disease, ischemic injury (such as that caused by myocardial infarction, stroke and reperfusion injury), liver injury (e.g., hepatitis related liver injury, ischemia/reperfusion injury, cholestasis (bile duct injury) and liver cancer); toxin-induced liver disease (such as that caused by alcohol), septic shock, cachexia and anorexia.

[0618] Hyperproliferative diseases and/or disorders that could be diagnosed, prognosed, prevented, and/or treated by polynucleotides, polypeptides, and/or agonists or antagonists of the invention, include, but are not limited to, neoplasms located in the liver, abdomen, bone, breast, digestive system, pancreas, peritoneum, endocrine glands (adrenal, parathyroid, pituitary, testicles, ovary, thymus, thyroid), eye, head and neck, nervous system (central and peripheral), lymphatic system, pelvis, skin, soft tissue, spleen, thorax, and urogenital tract.

[0619] Similarly, other hyperproliferative disorders can also be diagnosed, prognosed, prevented, and/or treated by polynucleotides, polypeptides, and/or agonists or antagonists of the invention. Examples of such hyperproliferative disorders include, but are not limited to: hypergammaglobulinemia, lymphoproliferative disorders, paraproteinemias, purpura, sarcoidosis, Sezary Syndrome, Waldenström's macroglobulinemia, Gaucher's Disease, histiocytosis, and any other hyperproliferative disease, besides neoplasia, located in an organ system listed above.

[0620] One preferred embodiment utilizes polynucleotides of the present invention to inhibit aberrant cellular division, by gene therapy using the present invention, and/or protein fusions or fragments thereof.

[0621] Thus, the present invention provides a method for treating cell proliferative diseases, disorders, and/or conditions by inserting into an abnormally proliferating cell a polynucleotide of the present invention, wherein said polynucleotide represses said cell proliferation, disease, disorder, and/or condition.

[0622] In a preferred embodiment, the present invention provides a method for treating cell proliferative diseases, disorders and/or conditions of the reproductive system by inserting into a cell, a polynucleotide of the present invention, wherein said polynucleotide represses said cell proliferation, disease and/or disorder.

[0623] Another embodiment of the present invention provides a method of treating cell-proliferative diseases, disorders, and/or conditions in individuals comprising

administration of one or more active gene copies of the present invention to an abnormally proliferating cell or cells. In a preferred embodiment, polynucleotides of the present invention is a DNA construct comprising a recombinant expression vector effective in expressing a DNA sequence encoding said polynucleotides. In another preferred embodiment of the present invention, the DNA construct encoding the polynucleotides of the present invention is inserted into cells to be treated utilizing a retrovirus, or more preferably an adenoviral vector (see, e.g., G J. Nabel, et. al., PNAS 96: 324-326 (1999), which is hereby incorporated by reference). In a most preferred embodiment, the viral vector is defective and will not transform non-proliferating cells, only proliferating cells. Moreover, in a preferred embodiment, the polynucleotides of the present invention inserted into proliferating cells either alone, or in combination with or fused to other polynucleotides, can then be modulated via an external stimulus (i.e., magnetic, specific small molecule, chemical, or drug administration, etc.), which acts upon the promoter upstream of said polynucleotides to induce expression of the encoded protein product. As such the beneficial therapeutic affect of the present invention may be expressly modulated (i.e., to increase, decrease, or inhibit expression of the present invention) based upon said external stimulus.

[0624] Polynucleotides of the present invention may be useful in repressing expression of oncogenic genes or antigens. By "repressing expression of the oncogenic genes " is intended the suppression of the transcription of the gene, the degradation of the gene transcript (pre-message RNA), the inhibition of splicing, the destruction of the messenger RNA, the prevention of the post-translational modifications of the protein, the destruction of the protein, or the inhibition of the normal function of the protein.

[0625] For local administration to abnormally proliferating cells, polynucleotides of the present invention may be administered by any method known to those of skill in the art including, but not limited to transfection, electroporation, microinjection of cells, or in vehicles such as liposomes, lipofectin, or as naked polynucleotides, or any other method described throughout the specification. The polynucleotide of the present invention may be delivered by known gene delivery systems such as, but not limited to, retroviral vectors (Gilboa, J. Virology 44:845 (1982); Hocke, Nature

320:275 (1986); Wilson, et al., Proc. Natl. Acad. Sci. U.S.A. 85:3014), vaccinia virus system (Chakrabarty et al., Mol. Cell Biol. 5:3403 (1985) or other efficient DNA delivery systems (Yates et al., Nature 313:812 (1985)) known to those skilled in the art. These references are exemplary only and are hereby incorporated by reference. In order to specifically deliver or transfect cells which are abnormally proliferating and spare non-dividing cells, it is preferable to utilize a retrovirus, or adenoviral (as described in the art and elsewhere herein) delivery system known to those of skill in the art. Since host DNA replication is required for retroviral DNA to integrate and the retrovirus will be unable to self replicate due to the lack of the retrovirus genes needed for its life cycle. Utilizing such a retroviral delivery system for polynucleotides of the present invention will target said gene and constructs to abnormally proliferating cells and will spare the non-dividing normal cells.

[0626] The polynucleotides of the present invention may be delivered directly to cell proliferative disorder/disease sites in internal organs, body cavities and the like by use of imaging devices used to guide an injecting needle directly to the disease site. The polynucleotides of the present invention may also be administered to disease sites at the time of surgical intervention.

[0627] By "cell proliferative disease" is meant any human or animal disease or disorder, affecting any one or any combination of organs, cavities, or body parts, which is characterized by single or multiple local abnormal proliferations of cells, groups of cells, or tissues, whether benign or malignant.

[0628] Any amount of the polynucleotides of the present invention may be administered as long as it has a biologically inhibiting effect on the proliferation of the treated cells. Moreover, it is possible to administer more than one of the polynucleotide of the present invention simultaneously to the same site. By "biologically inhibiting" is meant partial or total growth inhibition as well as decreases in the rate of proliferation or growth of the cells. The biologically inhibitory dose may be determined by assessing the effects of the polynucleotides of the present invention on target malignant or abnormally proliferating cell growth in tissue culture, tumor growth in animals and cell cultures, or any other method known to one of ordinary skill in the art.

[0629] The present invention is further directed to antibody-based therapies which involve administering of anti-polypeptides and anti-polynucleotide antibodies to a mammalian, preferably human, patient for treating one or more of the described diseases, disorders, and/or conditions. Methods for producing anti-polypeptides and anti-polynucleotide antibodies polyclonal and monoclonal antibodies are described in detail elsewhere herein. Such antibodies may be provided in pharmaceutically acceptable compositions as known in the art or as described herein.

[0630] A summary of the ways in which the antibodies of the present invention may be used therapeutically includes binding polynucleotides or polypeptides of the present invention locally or systemically in the body or by direct cytotoxicity of the antibody, e.g., as mediated by complement (CDC) or by effector cells (ADCC). Some of these approaches are described in more detail below. Armed with the teachings provided herein, one of ordinary skill in the art will know how to use the antibodies of the present invention for diagnostic, monitoring or therapeutic purposes without undue experimentation.

[0631] In particular, the antibodies, fragments and derivatives of the present invention are useful for treating a subject having or developing cell proliferative and/or differentiation diseases, disorders, and/or conditions as described herein. Such treatment comprises administering a single or multiple doses of the antibody, or a fragment, derivative, or a conjugate thereof.

[0632] The antibodies of this invention may be advantageously utilized in combination with other monoclonal or chimeric antibodies, or with lymphokines or hematopoietic growth factors, for example, which serve to increase the number or activity of effector cells which interact with the antibodies.

[0633] It is preferred to use high affinity and/or potent *in vivo* inhibiting and/or neutralizing antibodies against polypeptides or polynucleotides of the present invention, fragments or regions thereof, for both immunoassays directed to and therapy of diseases, disorders, and/or conditions related to polynucleotides or polypeptides, including fragments thereof, of the present invention. Such antibodies, fragments, or regions, will preferably have an affinity for polynucleotides or polypeptides, including fragments thereof. Preferred binding affinities include those with a dissociation constant or K_d less than $5 \times 10^{-6}M$, $10^{-6}M$, $5 \times 10^{-7}M$, $10^{-7}M$, $5 \times 10^{-8}M$.

^8M , 10^{-8}M , $5 \times 10^{-9}\text{M}$, 10^{-9}M , $5 \times 10^{-10}\text{M}$, 10^{-10}M , $5 \times 10^{-11}\text{M}$, 10^{-11}M , $5 \times 10^{-12}\text{M}$, 10^{-12}M , $5 \times 10^{-13}\text{M}$, 10^{-13}M , $5 \times 10^{-14}\text{M}$, 10^{-14}M , $5 \times 10^{-15}\text{M}$, and 10^{-15}M .

[0634] Moreover, reproductive system antigen polypeptides of the present invention or fragments thereof, are useful in inhibiting the angiogenesis of proliferative cells or tissues, either alone, as a protein fusion, or in combination with other polypeptides directly or indirectly, as described elsewhere herein. In a most preferred embodiment, said anti-angiogenesis effect may be achieved indirectly, for example, through the inhibition of hematopoietic, tumor-specific cells, such as tumor-associated macrophages (see, e.g., Joseph IB, et al. *J Natl Cancer Inst*, 90(21):1648-53 (1998), which is hereby incorporated by reference). Antibodies directed to polypeptides or polynucleotides of the present invention may also result in inhibition of angiogenesis directly, or indirectly (see, e.g., Witte L, et al., *Cancer Metastasis Rev.* 17(2):155-61 (1998), which is hereby incorporated by reference)).

[0635] Polypeptides, including protein fusions, of the present invention, or fragments thereof may be useful in inhibiting proliferative cells or tissues through the induction of apoptosis. Said polypeptides may act either directly, or indirectly to induce apoptosis of proliferative cells and tissues, for example in the activation of a death-domain receptor, such as tumor necrosis factor (TNF) receptor-1, CD95 (Fas/APO-1), TNF-receptor-related apoptosis-mediated protein (TRAMP) and TNF-related apoptosis-inducing ligand (TRAIL) receptor-1 and -2 (see, e.g., Schulze-Osthoff K, et al., *Eur J Biochem* 254(3):439-59 (1998), which is hereby incorporated by reference). Moreover, in another preferred embodiment of the present invention, said polypeptides may induce apoptosis through other mechanisms, such as in the activation of other proteins which will activate apoptosis, or through stimulating the expression of said proteins, either alone or in combination with small molecule drugs or adjuvants, such as apoptonin, galectins, thioredoxins, antiinflammatory proteins (See for example, *Mutat. Res.* 400(1-2):447-55 (1998), *Med Hypotheses* 50(5):423-33 (1998), *Chem. Biol. Interact.* Apr 24;111-112:23-34 (1998), *J. Mo. Med.* 76(6):402-12 (1998), *Int. J. Tissue React.* 20(1):3-15 (1998), which are all hereby incorporated by reference).

[0636] Polypeptides, including protein fusions to, or fragments thereof, of the present invention are useful in inhibiting the metastasis of proliferative cells or tissues.

Inhibition may occur as a direct result of administering polypeptides, or antibodies directed to said polypeptides as described elsewhere herein, or indirectly, such as activating the expression of proteins known to inhibit metastasis, for example alpha 4 integrins, (See, e.g., Curr Top Microbiol Immunol 1998;231:125-41, which is hereby incorporated by reference). Such therapeutic affects of the present invention may be achieved either alone, or in combination with small molecule drugs or adjuvants.

[0637] In another embodiment, the invention provides a method of delivering compositions containing the polypeptides of the invention (e.g., compositions containing polypeptides or anti-reproductive system antigen polypeptide antibodies associated with heterologous polypeptides, heterologous nucleic acids, toxins, or prodrugs) to targeted cells expressing the polypeptide of the present invention: reproductive system antigen polypeptides or anti-reproductive system antigen polypeptide antibodies of the invention may be associated with heterologous polypeptides, heterologous nucleic acids, toxins, or prodrugs via hydrophobic, hydrophilic, ionic and/or covalent interactions.

[0638] Polypeptides, protein fusions to, or fragments thereof, of the present invention are useful in enhancing the immunogenicity and/or antigenicity of proliferating cells or tissues, either directly, such as would occur if the polypeptides of the present invention 'vaccinated' the immune response to respond to proliferative antigens and immunogens, or indirectly, such as in activating the expression of proteins known to enhance the immune response (e.g. chemokines), to said antigens and immunogens.

Urinary System Disorders

[0639] Polynucleotides, polypeptides, antibodies, and/or agonists or antagonists of the present invention, may be used to treat, prevent, diagnose, and/or prognose disorders of the urinary system, including but not limited to disorders of the renal system, bladder, ureters, and urethra. Renal disorders include, but are not limited to, kidney failure, nephritis, blood vessel disorders of kidney, metabolic and congenital kidney disorders, urinary disorders of the kidney, autoimmune disorders, sclerosis and necrosis, electrolyte imbalance, and kidney cancers.

- [0640] Kidney failure diseases include, but are not limited to, acute kidney failure, chronic kidney failure, atheroembolic renal failure, and end-stage renal disease. Inflammatory diseases of the kidney include acute glomerulonephritis, postinfectious glomerulonephritis, rapidly progressive glomerulonephritis, nephrotic syndrome, membranous glomerulonephritis, familial nephrotic syndrome, membranoproliferative glomerulonephritis I and II, mesangial proliferative glomerulonephritis, chronic glomerulonephritis, acute tubulointerstitial nephritis, chronic tubulointerstitial nephritis, acute post-streptococcal glomerulonephritis (PSGN), pyelonephritis, lupus nephritis, chronic nephritis, interstitial nephritis, and post-streptococcal glomerulonephritis.
- [0641] Blood vessel disorders of the kidneys include, but are not limited to, kidney infarction, atheroembolic kidney disease, cortical necrosis, malignant nephrosclerosis, renal vein thrombosis, renal underperfusion, renal ischemia-reperfusion, renal artery embolism, and renal artery stenosis. Kidney disorders resulting from urinary tract problems include, but are not limited to, pyelonephritis, hydronephrosis, urolithiasis (renal lithiasis, nephrolithiasis), reflux nephropathy, urinary tract infections, urinary retention, and acute or chronic unilateral obstructive uropathy.
- [0642] Metabolic and congenital disorders of the kidneys include, but are not limited to, renal tubular acidosis, renal glycosuria, nephrogenic diabetes insipidus, cystinuria, Fanconi's syndrome, vitamin D-resistant rickets, Hartnup disease, Bartter's syndrome, Liddle's syndrome, polycystic kidney disease, medullary cystic disease, medullary sponge kidney, Alport's syndrome, nail-patella syndrome, congenital nephrotic syndrome, CRUSH syndrome, horseshoe kidney, diabetic nephropathy, nephrogenic diabetes insipidus, analgesic nephropathy, kidney stones, and membranous nephropathy. Kidney disorders resulting from an autoimmune response include, but are not limited to, systemic lupus erythematosus (SLE), Goodpasture syndrome, IgA nephropathy, and IgM mesangial proliferative glomerulonephritis.
- [0643] Sclerotic or necrotic disorders of the kidney include, but are not limited to, glomerulosclerosis, diabetic nephropathy, focal segmental glomerulosclerosis (FSGS), necrotizing glomerulonephritis, and renal papillary necrosis. Kidneys may also develop carcinomas, including, but not limited to, hypernephroma, nephroblastoma, renal cell cancer, transitional cell cancer, squamous cell cancer, and Wilms' tumor.

[0644] Kidney disorders may also result in electrolyte imbalances, including, but not limited to, nephrocalcinosis, pyuria, edema, hydronephritis, proteinuria, hyponatremia, hypernatremia, hypokalemia, hyperkalemia, hypocalcemia, hypercalcemia, hypophosphatemia, and hyperphosphatemia.

[0645] Bladder disorders include, but are not limited to, benign prostatic hyperplasia (BPH), interstitial cystitis (IC), prostatitis, proteinuria, urinary tract infections, urinary incontinence, urinary retention. Disorders of the ureters and urethra include, but are not limited to, acute or chronic unilateral obstructive uropathy. The bladder, ureters, and urethra may also develop carcinomas, including, but not limited to, superficial bladder cancer, invasive bladder cancer, carcinoma of the ureter, and urethra cancers.

[0646] Polypeptides may be administered using any method known in the art, including, but not limited to, direct needle injection at the delivery site, intravenous injection, topical administration, catheter infusion, biolistic injectors, particle accelerators, gelfoam sponge depots, other commercially available depot materials, osmotic pumps, oral or suppositorial solid pharmaceutical formulations, decanting or topical applications during surgery, aerosol delivery. Such methods are known in the art. Polypeptides may be administered as part of a Therapeutic, described in more detail below. Methods of delivering polynucleotides are described in more detail herein.

Cardiovascular Disorders

[0647] Polynucleotides or polypeptides, or agonists or antagonists of the present invention, may be used to treat, prevent, diagnose, and/or prognose cardiovascular disorders, including, but not limited to, peripheral artery disease, such as limb ischemia.

[0648] Cardiovascular disorders include cardiovascular abnormalities, such as arterio-arterial fistula, arteriovenous fistula, cerebral arteriovenous malformations, congenital heart defects, pulmonary atresia, and Scimitar Syndrome. Congenital heart defects include aortic coarctation, cor triatriatum, coronary vessel anomalies, crisscross heart, dextrocardia, patent ductus arteriosus, Ebstein's anomaly, Eisenmenger complex, hypoplastic left heart syndrome, levocardia, tetralogy of fallot,

transposition of great vessels, double outlet right ventricle, tricuspid atresia, persistent truncus arteriosus, total anomalous pulmonary venous connection, hypoplastic left heart syndrome, and heart septal defects, such as aortopulmonary septal defect, endocardial cushion defects, Lutembacher's Syndrome, atrioventricular canal defect, trilog of Fallot, ventricular heart septal defects.

[0649] Cardiovascular disorders also include heart disease, such as arrhythmias, carcinoid heart disease, high cardiac output, low cardiac output, cardiac tamponade, endocarditis (including bacterial), heart aneurysm, cardiac arrest, sudden cardiac death, congestive heart failure, congestive cardiomyopathy, paroxysmal dyspnea, cardiac edema, heart hypertrophy, congestive cardiomyopathy, left ventricular hypertrophy, right ventricular hypertrophy, post-infarction heart rupture, ventricular septal rupture, heart valve diseases, myocardial diseases, myocardial ischemia, pericardial effusion, pericarditis (including constrictive and tuberculous), pneumopericardium, postpericardiotomy syndrome, pulmonary heart disease, rheumatic heart disease, ventricular dysfunction, hyperemia, cardiovascular pregnancy complications, Scimitar Syndrome, diastolic dysfunction, enlarged heart, heart block, J-curve phenomenon, rheumatic heart disease, Marfan syndrome, cardiovascular syphilis, and cardiovascular tuberculosis.

[0650] Arrhythmias include sinus arrhythmia, atrial fibrillation, atrial flutter, bradycardia, extrasystole, Adams-Stokes Syndrome, bundle-branch block, sinoatrial block, long QT syndrome, parasystole, Lown-Ganong-Levine Syndrome, Mahaim-type pre-excitation syndrome, Wolff-Parkinson-White syndrome, sick sinus syndrome, tachycardias, and ventricular fibrillation. Tachycardias include paroxysmal tachycardia, supraventricular tachycardia, accelerated idioventricular rhythm, atrioventricular nodal reentry tachycardia, ectopic atrial tachycardia, ectopic junctional tachycardia, sinoatrial nodal reentry tachycardia, sinus tachycardia, Torsades de Pointes, and ventricular tachycardia.

[0651] Heart valve disease include aortic valve insufficiency, aortic valve stenosis, heart murmurs, aortic valve prolapse, mitral valve prolapse, tricuspid valve prolapse, mitral valve insufficiency, mitral valve stenosis, pulmonary atresia, pulmonary valve insufficiency, pulmonary valve stenosis, tricuspid atresia, tricuspid valve insufficiency, tricuspid valve stenosis, and bicuspid aortic valve.

- [0652] Myocardial diseases include alcoholic cardiomyopathy, congestive cardiomyopathy, hypertrophic cardiomyopathy, aortic subvalvular stenosis, pulmonary subvalvular stenosis, restrictive cardiomyopathy, Chagas cardiomyopathy, endocardial fibroelastosis, endomyocardial fibrosis, Kearns Syndrome, Barth syndrome, myocardial reperfusion injury, and myocarditis.
- [0653] Myocardial ischemias include coronary disease, such as angina pectoris, Prinzmetal's angina, unstable angina, coronary aneurysm, coronary arteriosclerosis, coronary thrombosis, coronary vasospasm, myocardial infarction and myocardial stunning.
- [0654] Cardiovascular diseases also include vascular diseases such as aneurysms, angiodysplasia, angiomas, bacillary angiomas, Hippel-Lindau Disease, Klippel-Trenaunay-Weber Syndrome, Sturge-Weber Syndrome, angioneurotic edema, aortic diseases, Takayasu's Arteritis, aortitis, Leriche's Syndrome, arterial occlusive diseases, arteritis, enarteritis, polyarteritis nodosa, cerebrovascular disorders, diabetic angiopathies, diabetic retinopathy, embolisms, thrombosis, erythromelalgia, hemorrhoids, hepatic veno-occlusive disease, hypertension, hypotension (shock), ischemia, peripheral vascular diseases, phlebitis, superficial phlebitis, pulmonary veno-occlusive disease, chronic obstructive pulmonary disease, Buerger's disease, Raynaud's disease, CREST syndrome, retinal vein occlusion, Scimitar syndrome, superior vena cava syndrome, telangiectasia, ataxia telangiectasia, hereditary hemorrhagic telangiectasia, deep vein thrombosis, varicocele, varicose veins, varicose ulcer, vasculitis, and venous insufficiency.
- [0655] Aneurysms include dissecting aneurysms, false aneurysms, infected aneurysms, ruptured aneurysms, aortic aneurysms, cerebral aneurysms, coronary aneurysms, heart aneurysms, and iliac aneurysms.
- [0656] Arterial occlusive diseases include arteriosclerosis, arteriolosclerosis, atherosclerosis, intermittent claudication, carotid stenosis, fibromuscular dysplasias, mesenteric vascular occlusion, Moyamoya disease, renal artery obstruction, retinal artery occlusion, and thromboangiitis obliterans.
- [0657] Cerebrovascular disorders include carotid artery diseases, cerebral amyloid angiopathy, cerebral aneurysm, cerebral anoxia, cerebral arteriosclerosis, cerebral arteriovenous malformation, cerebral artery diseases, cerebral embolism and

thrombosis, carotid artery thrombosis, sinus thrombosis, Wallenberg's syndrome, cerebral hemorrhage, epidural hematoma, subdural hematoma, subarachnoid hemorrhage, cerebral infarction, cerebral ischemia (including transient), subclavian steal syndrome, periventricular leukomalacia, vascular headache, cluster headache, migraine, and vertebrobasilar insufficiency.

[0658] Embolisms include air embolisms, amniotic fluid embolisms, cholesterol embolisms, blue toe syndrome, fat embolisms, pulmonary embolisms, and thromboembolisms. Thrombosis include coronary thrombosis, hepatic vein thrombosis, deep vein thrombosis, retinal vein occlusion, carotid artery thrombosis, sinus thrombosis, Wallenberg's syndrome, and thrombophlebitis.

[0659] Ischemia includes cerebral ischemia, ischemic colitis, silent ischemia, compartment syndromes, anterior compartment syndrome, myocardial ischemia, reperfusion injuries, and peripheral limb ischemia. Vasculitis includes aortitis, arteritis, Behcet's Syndrome, Churg-Strauss Syndrome, mucocutaneous lymph node syndrome, thromboangiitis obliterans, hypersensitivity vasculitis, Schoenlein-Henoch purpura, allergic cutaneous vasculitis, and Wegener's granulomatosis.

[0660] Cardiovascular diseases can also occur due to electrolyte imbalances that include, but are not limited to hyponatremia, hypernatremia, hypokalemia, hyperkalemia, hypocalcemia, hypercalcemia, hypophosphatemia, and hyperphosphatemia. Neoplasm and/or cancers of the cardiovascular system include, but are not limited to, myxomas, fibromas, and rhabdomyomas.

[0661] Polypeptides may be administered using any method known in the art, including, but not limited to, direct needle injection at the delivery site, intravenous injection, topical administration, catheter infusion, biolistic injectors, particle accelerators, gelfoam sponge depots, other commercially available depot materials, osmotic pumps, oral or suppositorial solid pharmaceutical formulations, decanting or topical applications during surgery, aerosol delivery. Such methods are known in the art. Polypeptides may be administered as part of a Therapeutic, described in more detail below. Methods of delivering polynucleotides are described in more detail herein.

Respiratory Disorders

[0662] Polynucleotides or polypeptides, or agonists or antagonists of the present invention may be used to treat, prevent, diagnose, and/or prognose diseases and/or disorders of the respiratory system.

[0663] Diseases and disorders of the respiratory system include, but are not limited to, nasal vestibulitis, nonallergic rhinitis (e.g., acute rhinitis, chronic rhinitis, atrophic rhinitis, vasomotor rhinitis), nasal polyps, and sinusitis, juvenile angiofibromas, cancer of the nose and juvenile papillomas, vocal cord polyps, nodules (singer's nodules), contact ulcers, vocal cord paralysis, laryngoceles, pharyngitis (e.g., viral and bacterial), tonsillitis, tonsillar cellulitis, parapharyngeal abscess, laryngitis, laryngoceles, and throat cancers (e.g., cancer of the nasopharynx, tonsil cancer, larynx cancer), lung cancer (e.g., squamous cell carcinoma, small cell (oat cell) carcinoma, large cell carcinoma, and adenocarcinoma), allergic disorders (eosinophilic pneumonia, hypersensitivity pneumonitis (e.g., extrinsic allergic alveolitis, allergic interstitial pneumonitis, organic dust pneumoconiosis, allergic bronchopulmonary aspergillosis, asthma, Wegener's granulomatosis (granulomatous vasculitis), Goodpasture's syndrome)), pneumonia (e.g., bacterial pneumonia (e.g., *Streptococcus pneumoniae* (pneumococcal pneumonia), *Staphylococcus aureus* (staphylococcal pneumonia), Gram-negative bacterial pneumonia (caused by, e.g., *Klebsiella* and *Pseudomonas spp.*), *Mycoplasma pneumoniae* pneumonia, *Hemophilus influenzae* pneumonia, *Legionella pneumophila* (Legionnaires' disease), and *Chlamydia psittaci* (Psittacosis))), and viral pneumonia (e.g., influenza, chickenpox (varicella).

[0664] Additional diseases and disorders of the respiratory system include, but are not limited to bronchiolitis, polio (poliomyelitis), croup, respiratory syncytial viral infection, mumps, erythema infectiosum (fifth disease), roseola infantum, progressive rubella panencephalitis, german measles, and subacute sclerosing panencephalitis), fungal pneumonia (e.g., Histoplasmosis, Coccidioidomycosis, Blastomycosis, fungal infections in people with severely suppressed immune systems (e.g., cryptococcosis, caused by *Cryptococcus neoformans*; aspergillosis, caused by *Aspergillus spp.*; candidiasis, caused by *Candida*; and mucormycosis)), *Pneumocystis carinii* (pneumocystis pneumonia), atypical pneumonias (e.g., *Mycoplasma* and *Chlamydia spp.*), opportunistic infection pneumonia, nosocomial pneumonia, chemical

pneumonitis, and aspiration pneumonia, pleural disorders (e.g., pleurisy, pleural effusion, and pneumothorax (e.g., simple spontaneous pneumothorax, complicated spontaneous pneumothorax, tension pneumothorax)), obstructive airway diseases (e.g., asthma, chronic obstructive pulmonary disease (COPD), emphysema, chronic or acute bronchitis), occupational lung diseases (e.g., silicosis, black lung (coal workers' pneumoconiosis), asbestosis, berylliosis, occupational asthma, byssinosis, and benign pneumoconioses), Infiltrative Lung Disease (e.g., pulmonary fibrosis (e.g., fibrosing alveolitis, usual interstitial pneumonia), idiopathic pulmonary fibrosis, desquamative interstitial pneumonia, lymphoid interstitial pneumonia, histiocytosis X (e.g., Letterer-Siwe disease, Hand-Schüller-Christian disease, eosinophilic granuloma), idiopathic pulmonary hemosiderosis, sarcoidosis and pulmonary alveolar proteinosis), Acute respiratory distress syndrome (also called, e.g., adult respiratory distress syndrome), edema, pulmonary embolism, bronchitis (e.g., viral, bacterial), bronchiectasis, atelectasis, lung abscess (caused by, e.g., *Staphylococcus aureus* or *Legionella pneumophila*), and cystic fibrosis.

Anti-Angiogenesis Activity

[0665] The naturally occurring balance between endogenous stimulators and inhibitors of angiogenesis is one in which inhibitory influences predominate. Rastinejad *et al.*, *Cell* 56:345-355 (1989). In those rare instances in which neovascularization occurs under normal physiological conditions, such as wound healing, organ regeneration, embryonic development, and female reproductive processes, angiogenesis is stringently regulated and spatially and temporally delimited. Under conditions of pathological angiogenesis such as that characterizing solid tumor growth, these regulatory controls fail. Unregulated angiogenesis becomes pathologic and sustains progression of many neoplastic and non-neoplastic diseases. A number of serious diseases are dominated by abnormal neovascularization including solid tumor growth and metastases, arthritis, some types of eye disorders, and psoriasis. See, e.g., reviews by Moses *et al.*, *Biotech.* 9:630-634 (1991); Folkman *et al.*, *N. Engl. J. Med.*, 333:1757-1763 (1995); Auerbach *et al.*, *J. Microvasc. Res.* 29:401-411 (1985); Folkman, *Advances in Cancer Research*, eds. Klein and Weinhouse, Academic Press, New York, pp. 175-203 (1985); Patz, *Am. J. Ophthalmol.* 94:715-743 (1982); and

Folkman *et al.*, *Science* 221:719-725 (1983). In a number of pathological conditions, the process of angiogenesis contributes to the disease state. For example, significant data have accumulated which suggest that the growth of solid tumors is dependent on angiogenesis. Folkman and Klagsbrun, *Science* 235:442-447 (1987).

[0666] The present invention provides for treatment of diseases or disorders associated with neovascularization by administration of the polynucleotides and/or polypeptides of the invention, as well as agonists or antagonists of the present invention. Malignant and metastatic conditions which can be treated with the polynucleotides and polypeptides, or agonists or antagonists of the invention include, but are not limited to, malignancies, solid tumors, and cancers described herein and otherwise known in the art (for a review of such disorders, see Fishman *et al.*, *Medicine*, 2d Ed., J. B. Lippincott Co., Philadelphia (1985)). Thus, the present invention provides a method of treating an angiogenesis-related disease and/or disorder, comprising administration to an individual in need thereof a therapeutically effective amount of a polynucleotide, polypeptide, antagonist and/or agonist of the invention. For example, polynucleotides, polypeptides, antagonists and/or agonists may be utilized in a variety of additional methods in order to therapeutically treat a cancer or tumor. Cancers which may be treated with polynucleotides, polypeptides, antagonists and/or agonists include, but are not limited to solid tumors, including prostate, lung, breast, ovarian, stomach, pancreas, larynx, esophagus, testes, liver, parotid, biliary tract, colon, rectum, cervix, uterus, endometrium, kidney, bladder, thyroid cancer; primary tumors and metastases; melanomas; glioblastoma; Kaposi's sarcoma; leiomyosarcoma; non-small cell lung cancer; colorectal cancer; advanced malignancies; and blood born tumors such as leukemias. For example, polynucleotides, polypeptides, antagonists and/or agonists may be delivered topically, in order to treat cancers such as skin cancer, head and neck tumors, breast tumors, and Kaposi's sarcoma.

[0667] Within yet other aspects, polynucleotides, polypeptides, antagonists and/or agonists may be utilized to treat superficial forms of bladder cancer by, for example, intravesical administration. Polynucleotides, polypeptides, antagonists and/or agonists may be delivered directly into the tumor, or near the tumor site, via injection or a catheter. Of course, as the artisan of ordinary skill will appreciate, the appropriate

mode of administration will vary according to the cancer to be treated. Other modes of delivery are discussed herein.

[0668] Polynucleotides, polypeptides, antagonists and/or agonists may be useful in treating other disorders, besides cancers, which involve angiogenesis. These disorders include, but are not limited to: benign tumors, for example hemangiomas, acoustic neuromas, neurofibromas, trachomas, and pyogenic granulomas; arteriosclerotic plaques; ocular angiogenic diseases, for example, diabetic retinopathy, retinopathy of prematurity, macular degeneration, corneal graft rejection, neovascular glaucoma, retrolental fibroplasia, rubeosis, retinoblastoma, uveitis and Pterygia (abnormal blood vessel growth) of the eye; rheumatoid arthritis; psoriasis; delayed wound healing; endometriosis; vasculogenesis; granulations; hypertrophic scars (keloids); nonunion fractures; scleroderma; trachoma; vascular adhesions; myocardial angiogenesis; coronary collaterals; cerebral collaterals; arteriovenous malformations; ischemic limb angiogenesis; Osler-Webber Syndrome; plaque neovascularization; telangiectasia; hemophilic joints; angiofibroma; fibromuscular dysplasia; wound granulation; Crohn's disease; and atherosclerosis.

[0669] For example, within one aspect of the present invention methods are provided for treating hypertrophic scars and keloids, comprising the step of administering a polynucleotide, polypeptide, antagonist and/or agonist of the invention to a hypertrophic scar or keloid.

[0670] Within one embodiment of the present invention polynucleotides, polypeptides, antagonists and/or agonists of the invention are directly injected into a hypertrophic scar or keloid, in order to prevent the progression of these lesions. This therapy is of particular value in the prophylactic treatment of conditions which are known to result in the development of hypertrophic scars and keloids (e.g., burns), and is preferably initiated after the proliferative phase has had time to progress (approximately 14 days after the initial injury), but before hypertrophic scar or keloid development. As noted above, the present invention also provides methods for treating neovascular diseases of the eye, including for example, corneal neovascularization, neovascular glaucoma, proliferative diabetic retinopathy, retrolental fibroplasia and macular degeneration.

[0671] Moreover, ocular disorders associated with neovascularization which can

be treated with the polynucleotides and polypeptides of the present invention (including agonists and/or antagonists) include, but are not limited to: neovascular glaucoma, diabetic retinopathy, retinoblastoma, retrolental fibroplasia, uveitis, retinopathy of prematurity, macular degeneration, corneal graft neovascularization, as well as other eye inflammatory diseases, ocular tumors and diseases associated with choroidal or iris neovascularization. See, e.g., reviews by Waltman *et al.*, *Am. J. Ophthalmol.* 85:704-710 (1978) and Gartner *et al.*, *Surv. Ophthalmol.* 22:291-312 (1978).

[0672] Thus, within one aspect of the present invention methods are provided for treating neovascular diseases of the eye such as corneal neovascularization (including corneal graft neovascularization), comprising the step of administering to a patient a therapeutically effective amount of a compound (as described above) to the cornea, such that the formation of blood vessels is inhibited. Briefly, the cornea is a tissue, which normally lacks blood vessels. In certain pathological conditions however, capillaries may extend into the cornea from the pericorneal vascular plexus of the limbus. When the cornea becomes vascularized, it also becomes clouded, resulting in a decline in the patient's visual acuity. Visual loss may become complete if the cornea completely opacitates. A wide variety of disorders can result in corneal neovascularization, including for example, corneal infections (e.g., trachoma, herpes simplex keratitis, leishmaniasis and onchocerciasis), immunological processes (e.g., graft rejection and Stevens-Johnson's syndrome), alkali burns, trauma, inflammation (of any cause), toxic and nutritional deficiency states, and as a complication of wearing contact lenses.

[0673] Within particularly preferred embodiments of the invention, may be prepared for topical administration in saline (combined with any of the preservatives and antimicrobial agents commonly used in ocular preparations), and administered in eyedrop form. The solution or suspension may be prepared in its pure form and administered several times daily. Alternatively, anti-angiogenic compositions; prepared as described above, may also be administered directly to the cornea. Within preferred embodiments, the anti-angiogenic composition is prepared with a muco-adhesive polymer, which binds to cornea. Within further embodiments, the anti-angiogenic factors or anti-angiogenic compositions may be utilized as an adjunct to conventional steroid therapy. Topical therapy may also be useful prophylactically in

corneal lesions which are known to have a high probability of inducing an angiogenic response (such as chemical burns). In these instances the treatment, likely in combination with steroids, may be instituted immediately to help prevent subsequent complications.

[0674] Within other embodiments, the compounds described above may be injected directly into the corneal stroma by an ophthalmologist under microscopic guidance. The preferred site of injection may vary with the morphology of the individual lesion, but the goal of the administration would be to place the composition at the advancing front of the vasculature (i.e., interspersed between the blood vessels and the normal cornea). In most cases this would involve perilimbic corneal injection to "protect" the cornea from the advancing blood vessels. This method may also be utilized shortly after a corneal insult in order to prophylactically prevent corneal neovascularization. In this situation, the material could be injected in the perilimbic cornea interspersed between the corneal lesion and its undesired potential limbic blood supply. Such methods may also be utilized in a similar fashion to prevent capillary invasion of transplanted corneas. In a sustained-release form, injections might only be required 2-3 times per year. A steroid could also be added to the injection solution to reduce inflammation resulting from the injection itself.

[0675] Within another aspect of the present invention, methods are provided for treating neovascular glaucoma, comprising the step of administering to a patient a therapeutically effective amount of a polynucleotide, polypeptide, antagonist and/or agonist to the eye, such that the formation of blood vessels is inhibited. In one embodiment, the compound may be administered topically to the eye in order to treat early forms of neovascular glaucoma. Within other embodiments, the compound may be implanted by injection into the region of the anterior chamber angle. Within other embodiments, the compound may also be placed in any location such that the compound is continuously released into the aqueous humor. Within another aspect of the present invention, methods are provided for treating proliferative diabetic retinopathy, comprising the step of administering to a patient a therapeutically effective amount of a polynucleotide, polypeptide, antagonist and/or agonist to the eyes, such that the formation of blood vessels is inhibited.

[0676] Within particularly preferred embodiments of the invention, proliferative

diabetic retinopathy may be treated by injection into the aqueous humor or the vitreous, in order to increase the local concentration of the polynucleotide, polypeptide, antagonist and/or agonist in the retina. Preferably, this treatment should be initiated prior to the acquisition of severe disease requiring photocoagulation.

[0677] Within another aspect of the present invention, methods are provided for treating retrolental fibroplasia, comprising the step of administering to a patient a therapeutically effective amount of a polynucleotide, polypeptide, antagonist and/or agonist to the eye, such that the formation of blood vessels is inhibited. The compound may be administered topically, via intravitreal injection and/or via intraocular implants.

[0678] Additionally, disorders which can be treated with the polynucleotides, polypeptides, agonists and/or antagonists include, but are not limited to, hemangioma, arthritis, psoriasis, angiofibroma, atherosclerotic plaques, delayed wound healing, granulations, hemophilic joints, hypertrophic scars, nonunion fractures, Osler-Weber syndrome, pyogenic granuloma, scleroderma, trachoma, and vascular adhesions.

[0679] Moreover, disorders and/or states, which can be treated, prevented, diagnosed and/or prognosed with the polynucleotides, polypeptides, agonists and/or antagonists of the invention include, but are not limited to, solid tumors, blood born tumors such as leukemias, tumor metastasis, Kaposi's sarcoma, benign tumors, for example hemangiomas, acoustic neuromas, neurofibromas, trachomas, and pyogenic granulomas, rheumatoid arthritis, psoriasis, ocular angiogenic diseases, for example, diabetic retinopathy, retinopathy of prematurity, macular degeneration, corneal graft rejection, neovascular glaucoma, retrolental fibroplasia, rubeosis, retinoblastoma, and uveitis, delayed wound healing, endometriosis, vasculogenesis, granulations, hypertrophic scars (keloids), nonunion fractures, scleroderma, trachoma, vascular adhesions, myocardial angiogenesis, coronary collaterals, cerebral collaterals, arteriovenous malformations, ischemic limb angiogenesis, Osler-Webber Syndrome, plaque neovascularization, telangiectasia, hemophilic joints, angiofibroma fibromuscular dysplasia, wound granulation, Crohn's disease, atherosclerosis, birth control agent by preventing vascularization required for embryo implantation controlling menstruation, diseases that have angiogenesis as a pathologic consequence

such as cat scratch disease (*Rochela minalia quintosa*), ulcers (*Helicobacter pylori*). Bartonellosis and bacillary angiomatosis.

[0680] In one aspect of the birth control method, an amount of the compound sufficient to block embryo implantation is administered before or after intercourse and fertilization have occurred, thus providing an effective method of birth control, possibly a "morning after" method. Polynucleotides, polypeptides, agonists and/or agonists may also be used in controlling menstruation or administered as either a peritoneal lavage fluid or for peritoneal implantation in the treatment of endometriosis.

[0681] Polynucleotides, polypeptides, agonists and/or agonists of the present invention may be incorporated into surgical sutures in order to prevent stitch granulomas.

[0682] Polynucleotides, polypeptides, agonists and/or agonists may be utilized in a wide variety of surgical procedures. For example, within one aspect of the present invention a compositions (in the form of, for example, a spray or film) may be utilized to coat or spray an area prior to removal of a tumor, in order to isolate normal surrounding tissues from malignant tissue, and/or to prevent the spread of disease to surrounding tissues. Within other aspects of the present invention, compositions (e.g., in the form of a spray) may be delivered via endoscopic procedures in order to coat tumors, or inhibit angiogenesis in a desired locale. Within yet other aspects of the present invention, surgical meshes, which have been coated with anti- angiogenic compositions of the present invention may be utilized in any procedure wherein a surgical mesh might be utilized. For example, within one embodiment of the invention a surgical mesh laden with an anti-angiogenic composition may be utilized during abdominal cancer resection surgery (e.g., subsequent to colon resection) in order to provide support to the structure, and to release an amount of the anti-angiogenic factor.

[0683] Within further aspects of the present invention, methods are provided for treating tumor excision sites, comprising administering a polynucleotide, polypeptide, agonist and/or agonist to the resection margins of a tumor subsequent to excision, such that the local recurrence of cancer and the formation of new blood vessels at the site is inhibited. Within one embodiment of the invention, the anti-angiogenic compound is administered directly to the tumor excision site (e.g., applied by swabbing, brushing or

otherwise coating the resection margins of the tumor with the anti-angiogenic compound). Alternatively, the anti-angiogenic compounds may be incorporated into known surgical pastes prior to administration. Within particularly preferred embodiments of the invention, the anti-angiogenic compounds are applied after hepatic resections for malignancy, and after neurosurgical operations.

[0684] Within one aspect of the present invention, polynucleotides, polypeptides, agonists and/or antagonists may be administered to the resection margin of a wide variety of tumors, including for example, breast, colon, brain and hepatic tumors. For example, within one embodiment of the invention, anti-angiogenic compounds may be administered to the site of a neurological tumor subsequent to excision, such that the formation of new blood vessels at the site are inhibited.

[0685] The polynucleotides, polypeptides, agonists and/or antagonists of the present invention may also be administered along with other anti-angiogenic factors. Representative examples of other anti-angiogenic factors include: Anti-Invasive Factor, retinoic acid and derivatives thereof, paclitaxel, Suramin, Tissue Inhibitor of Metalloproteinase-1, Tissue Inhibitor of Metalloproteinase-2, Plasminogen Activator Inhibitor-1, Plasminogen Activator Inhibitor-2, and various forms of the lighter "d group" transition metals.

[0686] Lighter "d group" transition metals include, for example, vanadium, molybdenum, tungsten, titanium, niobium, and tantalum species. Such transition metal species may form transition metal complexes. Suitable complexes of the above-mentioned transition metal species include oxo transition metal complexes.

[0687] Representative examples of vanadium complexes include oxo vanadium complexes such as vanadate and vanadyl complexes. Suitable vanadate complexes include metavanadate and orthovanadate complexes such as, for example, ammonium metavanadate, sodium metavanadate, and sodium orthovanadate. Suitable vanadyl complexes include, for example, vanadyl acetylacetonate and vanadyl sulfate including vanadyl sulfate hydrates such as vanadyl sulfate mono- and trihydrates.

[0688] Representative examples of tungsten and molybdenum complexes also include oxo complexes. Suitable oxo tungsten complexes include tungstate and tungsten oxide complexes. Suitable tungstate complexes include ammonium tungstate, calcium tungstate, sodium tungstate dihydrate, and tungstic acid. Suitable

tungsten oxides include tungsten (IV) oxide and tungsten (VI) oxide. Suitable oxo molybdenum complexes include molybdate, molybdenum oxide, and molybdenyl complexes. Suitable molybdate complexes include ammonium molybdate and its hydrates, sodium molybdate and its hydrates, and potassium molybdate and its hydrates. Suitable molybdenum oxides include molybdenum (VI) oxide, molybdenum (VI) oxide, and molybdic acid. Suitable molybdenyl complexes include, for example, molybdenyl acetylacetonate. Other suitable tungsten and molybdenum complexes include hydroxo derivatives derived from, for example, glycerol, tartaric acid, and sugars.

[0689] A wide variety of other anti-angiogenic factors may also be utilized within the context of the present invention. Representative examples include platelet factor 4; protamine sulphate; sulphated chitin derivatives (prepared from queen crab shells), (Murata et al., Cancer Res. 51:22-26 (1991)); Sulphated Polysaccharide Peptidoglycan Complex (SP- PG) (the function of this compound may be enhanced by the presence of steroids such as estrogen, and tamoxifen citrate); Staurosporine; modulators of matrix metabolism, including for example, proline analogs, cishydroxyproline, d,L-3,4-dehydroproline, Thiaproline, alpha,alpha-dipyridyl, aminopropionitrile fumarate; 4-propyl-5-(4-pyridinyl)-2(3H)-oxazolone; Methotrexate; Mitoxantrone; Heparin; Interferons; 2 Macroglobulin-serum; ChIMP-3 (Pavloff et al., J. Bio. Chem. 267:17321-17326 (1992)); Chymostatin (Tomkinson et al., Biochem J. 286:475-480 (1992)); Cyclodextrin Tetradecasulfate; Eponemycin; Camptothecin; Fumagillin (Ingber et al., Nature 348:555-557 (1990)); Gold Sodium Thiomalate ("GST"; Matsubara and Ziff, J. Clin. Invest. 79:1440-1446 (1987)); anticollagenase-serum; alpha2-antiplasmin (Holmes et al., J. Biol. Chem. 262(4):1659-1664 (1987)); Bisantrene (National Cancer Institute); Lobenzarit disodium (N-(2)-carboxyphenyl-4-chloroanthronilic acid disodium or "CCA"; Takeuchi et al., Agents Actions 36:312-316, 1992); Thalidomide; Angostatic steroid; AGM-1470; carboxynaminolmidazole; and metalloproteinase inhibitors such as BB94.

Musculoskeletal System Disorders

[0690] Polynucleotides, polypeptides, antibodies, and/or agonists or antagonists of the present invention, may be used to treat, prevent, diagnose, and/or prognose

disorders of the musculoskeletal system, including but not limited to, disorders of the bone, joints, ligaments, tendons, bursa, muscle, and/or neoplasms and cancers associated with musculoskeletal tissue.

[0691] Diseases or disorders of the bone include, but are not limited to, Albers-Schönberg disease, bowlegs, heel spurs, Köhler's bone disease, knock-knees, Legg-Calvé-Perthes disease, Marfan's syndrome, mucopolysaccharidoses, Osgood-Schlatter disease, osteochondroses, osteochondrodysplasia, osteomyelitis, osteopetroses, osteoporosis (postmenopausal, senile, and juvenile), Paget's disease, Scheuermann's disease, scoliosis, Sever's disease, and patellofemoral stress syndrome.

[0692] Joint diseases or disorders include, but are not limited to, ankylosing spondylitis, Behçet's syndrome, CREST syndrome, Ehlers-Danlos syndrome, infectious arthritis, discoid lupus erythematosus, systemic lupus erythematosus, Lyme disease, osteoarthritis, psoriatic arthritis, relapsing polychondrites, Reiter's syndrome, rheumatoid arthritis (adult and juvenile), scleroderma, and Still's disease.

[0693] Diseases or disorders affecting ligaments, tendons, or bursa include, but are not limited to, ankle sprain, bursitis, posterior Achilles tendon bursitis (Haglund's deformity), anterior Achilles tendon bursitis (Albert's disease), tendinitis, tenosynovitis, popliteus tendinitis, Achilles tendinitis, medial or lateral epicondylitis, rotator cuff tendinitis, spasmodic torticollis, and fibromyalgia syndrome.

[0694] Muscle diseases or disorders include, but are not limited to, Becker's muscular dystrophy, Duchenne's muscular dystrophy, Landouzy-Dejerine muscular dystrophy, Leyden-Möbius muscular dystrophy, Erb's muscular dystrophy, Charcot's joints, dermatomyositis, gout, pseudogout, glycogen storage diseases, Pompe's disease, mitochondrial myopathy, periodic paralysis, polymyalgia rheumatica, polymyositis, Steinert's disease, Thomsen's disease, anterolateral and posteromedial shin splints, posterior femoral muscle strain, and fibromyositis.

[0695] Musculoskeletal tissue may also develop cancers and/or neoplasms that include, but are not limited to, osteochondroma, benign chondroma, chondroblastoma, chondromyxoid fibroma, osteoid osteoma, giant cell tumor, multiple myeloma, osteosarcoma, fibrosarcoma, malignant fibrous histiocytoma, chondrosarcoma, Ewing's tumor, and malignant lymphoma of bone.

Neural Activity and Neurological Diseases

[0696] The polynucleotides, polypeptides and agonists or antagonists of the invention may be used for the diagnosis and/or treatment of diseases, disorders, damage or injury of the brain and/or nervous system. Nervous system disorders that can be treated with the compositions of the invention (e.g., polypeptides, polynucleotides, and/or agonists or antagonists), include, but are not limited to, nervous system injuries, and diseases or disorders which result in either a disconnection of axons, a diminution or degeneration of neurons, or demyelination. Nervous system lesions which may be treated in a patient (including human and non-human mammalian patients) according to the methods of the invention, include but are not limited to, the following lesions of either the central (including spinal cord, brain) or peripheral nervous systems: (1) ischemic lesions, in which a lack of oxygen in a portion of the nervous system results in neuronal injury or death, including cerebral infarction or ischemia, or spinal cord infarction or ischemia; (2) traumatic lesions, including lesions caused by physical injury or associated with surgery, for example, lesions which sever a portion of the nervous system, or compression injuries; (3) malignant lesions, in which a portion of the nervous system is destroyed or injured by malignant tissue which is either a nervous system associated malignancy or a malignancy derived from non-nervous system tissue; (4) infectious lesions, in which a portion of the nervous system is destroyed or injured as a result of infection, for example, by an abscess or associated with infection by human immunodeficiency virus, herpes zoster, or herpes simplex virus or with Lyme disease, tuberculosis, or syphilis; (5) degenerative lesions, in which a portion of the nervous system is destroyed or injured as a result of a degenerative process including but not limited to, degeneration associated with Parkinson's disease, Alzheimer's disease, Huntington's chorea, or amyotrophic lateral sclerosis (ALS); (6) lesions associated with nutritional diseases or disorders, in which a portion of the nervous system is destroyed or injured by a nutritional disorder or disorder of metabolism including, but not limited to, vitamin B12 deficiency, folic acid deficiency, Wernicke disease, tobacco-alcohol amblyopia, Marchiafava-Bignami disease (primary degeneration of the corpus callosum), and alcoholic cerebellar degeneration; (7) neurological lesions associated with systemic diseases including, but not limited to, diabetes (diabetic neuropathy,

Bell's palsy), systemic lupus erythematosus, carcinoma, or sarcoidosis; (8) lesions caused by toxic substances including alcohol, lead, or particular neurotoxins; and (9) demyelinated lesions in which a portion of the nervous system is destroyed or injured by a demyelinating disease including, but not limited to, multiple sclerosis, human immunodeficiency virus-associated myelopathy, transverse myelopathy or various etiologies, progressive multifocal leukoencephalopathy, and central pontine myelinolysis.

[0697] In one embodiment, the polypeptides, polynucleotides, or agonists or antagonists of the invention are used to protect neural cells from the damaging effects of hypoxia. In a further preferred embodiment, the polypeptides, polynucleotides, or agonists or antagonists of the invention are used to protect neural cells from the damaging effects of cerebral hypoxia. According to this embodiment, the compositions of the invention are used to treat or prevent neural cell injury associated with cerebral hypoxia. In one non-exclusive aspect of this embodiment, the polypeptides, polynucleotides, or agonists or antagonists of the invention, are used to treat or prevent neural cell injury associated with cerebral ischemia. In another non-exclusive aspect of this embodiment, the polypeptides, polynucleotides, or agonists or antagonists of the invention are used to treat or prevent neural cell injury associated with cerebral infarction.

[0698] In another preferred embodiment, the polypeptides, polynucleotides, or agonists or antagonists of the invention are used to treat or prevent neural cell injury associated with a stroke. In a specific embodiment, the polypeptides, polynucleotides, or agonists or antagonists of the invention are used to treat or prevent cerebral neural cell injury associated with a stroke.

[0699] In another preferred embodiment, the polypeptides, polynucleotides, or agonists or antagonists of the invention are used to treat or prevent neural cell injury associated with a heart attack. In a specific embodiment, the polypeptides, polynucleotides, or agonists or antagonists of the invention are used to treat or prevent cerebral neural cell injury associated with a heart attack.

[0700] The compositions of the invention which are useful for treating or preventing a nervous system disorder may be selected by testing for biological activity in promoting the survival or differentiation of neurons. For example, and not by way

of limitation, compositions of the invention which elicit any of the following effects may be useful according to the invention: (1) increased survival time of neurons in culture either in the presence or absence of hypoxia or hypoxic conditions; (2) increased sprouting of neurons in culture or *in vivo*; (3) increased production of a neuron-associated molecule in culture or *in vivo*, e.g., choline acetyltransferase or acetylcholinesterase with respect to motor neurons; or (4) decreased symptoms of neuron dysfunction *in vivo*. Such effects may be measured by any method known in the art. In preferred, non-limiting embodiments, increased survival of neurons may routinely be measured using a method set forth herein or otherwise known in the art, such as, for example, in Zhang *et al.*, *Proc Natl Acad Sci USA* 97:3637-42 (2000) or in Arakawa *et al.*, *J. Neurosci.*, 10:3507-15 (1990); increased sprouting of neurons may be detected by methods known in the art, such as, for example, the methods set forth in Pestronk *et al.*, *Exp. Neurol.*, 70:65-82 (1980), or Brown *et al.*, *Ann. Rev. Neurosci.*, 4:17-42 (1981); increased production of neuron-associated molecules may be measured by bioassay, enzymatic assay, antibody binding, Northern blot assay, etc., using techniques known in the art and depending on the molecule to be measured; and motor neuron dysfunction may be measured by assessing the physical manifestation of motor neuron disorder, e.g., weakness, motor neuron conduction velocity, or functional disability.

[0701] In specific embodiments, motor neuron disorders that may be treated according to the invention include, but are not limited to, disorders such as infarction, infection, exposure to toxin, trauma, surgical damage, degenerative disease or malignancy that may affect motor neurons as well as other components of the nervous system, as well as disorders that selectively affect neurons such as amyotrophic lateral sclerosis, and including, but not limited to, progressive spinal muscular atrophy, progressive bulbar palsy, primary lateral sclerosis, infantile and juvenile muscular atrophy, progressive bulbar paralysis of childhood (Fazio-Londe syndrome), poliomyelitis and the post polio syndrome, and Hereditary Motorsensory Neuropathy (Charcot-Marie-Tooth Disease).

[0702] Further, polypeptides or polynucleotides of the invention may play a role in neuronal survival; synapse formation; conductance; neural differentiation, etc. Thus, compositions of the invention (including polynucleotides, polypeptides, and agonists

or antagonists) may be used to diagnose and/or treat or prevent diseases or disorders associated with these roles, including, but not limited to, learning and/or cognition disorders. The compositions of the invention may also be useful in the treatment or prevention of neurodegenerative disease states and/or behavioural disorders. Such neurodegenerative disease states and/or behavioral disorders include, but are not limited to, Alzheimer's Disease, Parkinson's Disease, Huntington's Disease, Tourette Syndrome, schizophrenia, mania, dementia, paranoia, obsessive compulsive disorder, panic disorder, learning disabilities, ALS, psychoses, autism, and altered behaviors, including disorders in feeding, sleep patterns, balance, and perception. In addition, compositions of the invention may also play a role in the treatment, prevention and/or detection of developmental disorders associated with the developing embryo, or sexually-linked disorders.

[0703] Additionally, polypeptides, polynucleotides and/or agonists or antagonists of the invention, may be useful in protecting neural cells from diseases, damage, disorders, or injury, associated with cerebrovascular disorders including, but not limited to, carotid artery diseases (e.g., carotid artery thrombosis, carotid stenosis, or Moyamoya Disease), cerebral amyloid angiopathy, cerebral aneurysm, cerebral anoxia, cerebral arteriosclerosis, cerebral arteriovenous malformations, cerebral artery diseases, cerebral embolism and thrombosis (e.g., carotid artery thrombosis, sinus thrombosis, or Wallenberg's Syndrome), cerebral hemorrhage (e.g., epidural or subdural hematoma, or subarachnoid hemorrhage), cerebral infarction, cerebral ischemia (e.g., transient cerebral ischemia, Subclavian Steal Syndrome, or vertebrobasilar insufficiency), vascular dementia (e.g., multi-infarct), leukomalacia, periventricular, and vascular headache (e.g., cluster headache or migraines).

[0704] In accordance with yet a further aspect of the present invention, there is provided a process for utilizing polynucleotides or polypeptides, as well as agonists or antagonists of the present invention, for therapeutic purposes, for example, to stimulate neurological cell proliferation and/or differentiation. Therefore, polynucleotides, polypeptides, agonists and/or antagonists of the invention may be used to treat and/or detect neurologic diseases. Moreover, polynucleotides or polypeptides, or agonists or antagonists of the invention, can be used as a marker or detector of a particular nervous system disease or disorder.

[0705] Examples of neurologic diseases which can be treated or detected with polynucleotides, polypeptides, agonists, and/or antagonists of the present invention include brain diseases, such as metabolic brain diseases which includes phenylketonuria such as maternal phenylketonuria, pyruvate carboxylase deficiency, pyruvate dehydrogenase complex deficiency, Wernicke's Encephalopathy, brain edema, brain neoplasms such as cerebellar neoplasms which include infratentorial neoplasms, cerebral ventricle neoplasms such as choroid plexus neoplasms, hypothalamic neoplasms, supratentorial neoplasms, canavan disease, cerebellar diseases such as cerebellar ataxia which include spinocerebellar degeneration such as ataxia telangiectasia, cerebellar dyssynergia, Friederich's Ataxia, Machado-Joseph Disease, olivopontocerebellar atrophy, cerebellar neoplasms such as infratentorial neoplasms, diffuse cerebral sclerosis such as encephalitis periaxialis, globoid cell leukodystrophy, metachromatic leukodystrophy and subacute sclerosing panencephalitis.

[0706] Additional neurologic diseases which can be treated or detected with polynucleotides, polypeptides, agonists, and/or antagonists of the present invention include cerebrovascular disorders (such as carotid artery diseases which include carotid artery thrombosis, carotid stenosis and Moyamoya Disease), cerebral amyloid angiopathy, cerebral aneurysm, cerebral anoxia, cerebral arteriosclerosis, cerebral arteriovenous malformations, cerebral artery diseases, cerebral embolism and thrombosis such as carotid artery thrombosis, sinus thrombosis and Wallenberg's Syndrome, cerebral hemorrhage such as epidural hematoma, subdural hematoma and subarachnoid hemorrhage, cerebral infarction, cerebral ischemia such as transient cerebral ischemia, Subclavian Steal Syndrome and vertebrobasilar insufficiency, vascular dementia such as multi-infarct dementia, periventricular leukomalacia, vascular headache such as cluster headache and migraine.

[0707] Additional neurologic diseases which can be treated or detected with polynucleotides, polypeptides, agonists, and/or antagonists of the present invention include dementia such as AIDS Dementia Complex, presenile dementia such as Alzheimer's Disease and Creutzfeldt-Jakob Syndrome, senile dementia such as Alzheimer's Disease and progressive supranuclear palsy, vascular dementia such as multi-infarct dementia, encephalitis which include encephalitis periaxialis, viral

encephalitis such as epidemic encephalitis, Japanese Encephalitis, St. Louis Encephalitis, tick-borne encephalitis and West Nile Fever, acute disseminated encephalomyelitis, meningoencephalitis such as uveomeningoencephalitic syndrome, Postencephalitic Parkinson Disease and subacute sclerosing panencephalitis, encephalomalacia such as periventricular leukomalacia, epilepsy such as generalized epilepsy which includes infantile spasms, absence epilepsy, myoclonic epilepsy which includes MERRF Syndrome, tonic-clonic epilepsy, partial epilepsy such as complex partial epilepsy, frontal lobe epilepsy and temporal lobe epilepsy, post-traumatic epilepsy, status epilepticus such as Epilepsia Partialis Continua, and Hallervorden-Spatz Syndrome.

[0708] Additional neurologic diseases which can be treated or detected with polynucleotides, polypeptides, agonists, and/or antagonists of the present invention include hydrocephalus such as Dandy-Walker Syndrome and normal pressure hydrocephalus, hypothalamic diseases such as hypothalamic neoplasms, cerebral malaria, narcolepsy which includes cataplexy, bulbar poliomyelitis, cerebri pseudotumor, Rett Syndrome, Reye's Syndrome, thalamic diseases, cerebral toxoplasmosis, intracranial tuberculoma and Zellweger Syndrome, central nervous system infections such as AIDS Dementia Complex, Brain Abscess, subdural empyema, encephalomyelitis such as Equine Encephalomyelitis, Venezuelan Equine Encephalomyelitis, Necrotizing Hemorrhagic Encephalomyelitis, Visna, and cerebral malaria.

[0709] Additional neurologic diseases which can be treated or detected with polynucleotides, polypeptides, agonists, and/or antagonists of the present invention include meningitis such as arachnoiditis, aseptic meningitis such as viral meningitis which includes lymphocytic choriomeningitis, Bacterial meningitis which includes Haemophilus Meningitis, Listeria Meningitis, Meningococcal Meningitis such as Waterhouse-Friderichsen Syndrome, Pneumococcal Meningitis and meningeal tuberculosis, fungal meningitis such as Cryptococcal Meningitis, subdural effusion, meningoencephalitis such as uveomeningoencephalitic syndrome, myelitis such as transverse myelitis, neurosyphilis such as tabes dorsalis, poliomyelitis which includes bulbar poliomyelitis and postpoliomyelitis syndrome, prion diseases (such as

Creutzfeldt-Jakob Syndrome, Bovine Spongiform Encephalopathy, Gerstmann-Straussler Syndrome, Kuru, Scrapie), and cerebral toxoplasmosis.

[0710] Additional neurologic diseases which can be treated or detected with polynucleotides, polypeptides, agonists, and/or antagonists of the present invention include central nervous system neoplasms such as brain neoplasms that include cerebellar neoplasms such as infratentorial neoplasms, cerebral ventricle neoplasms such as choroid plexus neoplasms, hypothalamic neoplasms and supratentorial neoplasms, meningeal neoplasms, spinal cord neoplasms which include epidural neoplasms, demyelinating diseases such as Canavan Diseases, diffuse cerebral sclerosis which includes adrenoleukodystrophy, encephalitis periaxialis, globoid cell leukodystrophy, diffuse cerebral sclerosis such as metachromatic leukodystrophy, allergic encephalomyelitis, necrotizing hemorrhagic encephalomyelitis, progressive multifocal leukoencephalopathy, multiple sclerosis, central pontine myelinolysis, transverse myelitis, neuromyelitis optica, Scrapie, Swayback, Chronic Fatigue Syndrome, Visna, High Pressure Nervous Syndrome, Meningism, spinal cord diseases such as amyotonia congenita, amyotrophic lateral sclerosis, spinal muscular atrophy such as Werdnig-Hoffmann Disease, spinal cord compression, spinal cord neoplasms such as epidural neoplasms, syringomyelia, Tabes Dorsalis, Stiff-Man Syndrome, mental retardation such as Angelman Syndrome, Cri-du-Chat Syndrome, De Lange's Syndrome, Down Syndrome, Gangliosidoses such as gangliosidoses G(M1), Sandhoff Disease, Tay-Sachs Disease, Hartnup Disease, homocystinuria, Laurence-Moon-Biedl Syndrome, Lesch-Nyhan Syndrome, Maple Syrup Urine Disease, mucopolysaccharidosis such as fucosidosis, neuronal ceroid-lipofuscinosis, oculocerebrorenal syndrome, phenylketonuria such as maternal phenylketonuria, Prader-Willi Syndrome, Rett Syndrome, Rubinstein-Taybi Syndrome, Tuberous Sclerosis, WAGR Syndrome, nervous system abnormalities such as holoprosencephaly, neural tube defects such as anencephaly which includes hydranencephaly, Arnold-Chiari Deformity, encephalocele, meningocele, meningomyelocele, spinal dysraphism such as spina bifida cystica and spina bifida occulta.

[0711] Additional neurologic diseases which can be treated or detected with polynucleotides, polypeptides, agonists, and/or antagonists of the present invention include hereditary motor and sensory neuropathies which include Charcot-Marie

Disease, Hereditary optic atrophy, Refsum's Disease, hereditary spastic paraplegia, Werdnig-Hoffmann Disease, Hereditary Sensory and Autonomic Neuropathies such as Congenital Analgesia and Familial Dysautonomia, Neurologic manifestations (such as agnosia that include Gerstmann's Syndrome, Amnesia such as retrograde amnesia, apraxia, neurogenic bladder, cataplexy, communicative disorders such as hearing disorders that includes deafness, partial hearing loss, loudness recruitment and tinnitus, language disorders such as aphasia which include agraphia, anomia, broca aphasia, and Wernicke Aphasia, Dyslexia such as Acquired Dyslexia, language development disorders, speech disorders such as aphasia which includes anomia, broca aphasia and Wernicke Aphasia, articulation disorders, communicative disorders such as speech disorders which include dysarthria, echolalia, mutism and stuttering, voice disorders such as aphonia and hoarseness, decerebrate state, delirium, fasciculation, hallucinations, meningism, movement disorders such as angelman syndrome, ataxia, athetosis, chorea, dystonia, hypokinesia, muscle hypotonia, myoclonus, tic, torticollis and tremor, muscle hypertonia such as muscle rigidity such as stiff-man syndrome, muscle spasticity, paralysis such as facial paralysis which includes Herpes Zoster Oticus, Gastroparesis, Hemiplegia, ophthalmoplegia such as diplopia, Duane's Syndrome, Horner's Syndrome, Chronic progressive external ophthalmoplegia such as Kearns Syndrome, Bulbar Paralysis, Tropical Spastic Paraparesis, Paraplegia such as Brown-Sequard Syndrome, quadriplegia, respiratory paralysis and vocal cord paralysis, paresis, phantom limb, taste disorders such as ageusia and dysgeusia, vision disorders such as amblyopia, blindness, color vision defects, diplopia, hemianopsia, scotoma and subnormal vision, sleep disorders such as hypersomnia which includes Kleine-Levin Syndrome, insomnia, and somnambulism, spasm such as trismus, unconsciousness such as coma, persistent vegetative state and syncope and vertigo, neuromuscular diseases such as amyotonia congenita, amyotrophic lateral sclerosis, Lambert-Eaton Myasthenic Syndrome, motor neuron disease, muscular atrophy such as spinal muscular atrophy, Charcot-Marie Disease and Werdnig-Hoffmann Disease, Postpoliomyelitis Syndrome, Muscular Dystrophy, Myasthenia Gravis, Myotonia Atrophica, Myotonia Confenita, Nemaline Myopathy, Familial Periodic Paralysis, Multiplex Paramyoclonus, Tropical Spastic Paraparesis and Stiff-Man Syndrome, peripheral nervous system diseases such as acrodynia, amyloid neuropathies,

autonomic nervous system diseases such as Adie's Syndrome, Barre-Lieou Syndrome, Familial Dysautonomia, Horner's Syndrome, Reflex Sympathetic Dystrophy and Shy-Drager Syndrome, Cranial Nerve Diseases such as Acoustic Nerve Diseases such as Acoustic Neuroma which includes Neurofibromatosis 2, Facial Nerve Diseases such as Facial Neuralgia, Melkersson-Rosenthal Syndrome, ocular motility disorders which includes amblyopia, nystagmus, oculomotor nerve paralysis, ophthalmoplegia such as Duane's Syndrome, Horner's Syndrome, Chronic Progressive External Ophthalmoplegia which includes Kearns Syndrome, Strabismus such as Esotropia and Exotropia, Oculomotor Nerve Paralysis, Optic Nerve Diseases such as Optic Atrophy which includes Hereditary Optic Atrophy, Optic Disk Drusen, Optic Neuritis such as Neuromyelitis Optica, Papilledema, Trigeminal Neuralgia, Vocal Cord Paralysis, Demyelinating Diseases such as Neuromyelitis Optica and Swayback, and Diabetic neuropathies such as diabetic foot.

[0712] Additional neurologic diseases which can be treated or detected with polynucleotides, polypeptides, agonists, and/or antagonists of the present invention include nerve compression syndromes such as carpal tunnel syndrome, tarsal tunnel syndrome, thoracic outlet syndrome such as cervical rib syndrome, ulnar nerve compression syndrome, neuralgia such as causalgia, cervico-brachial neuralgia, facial neuralgia and trigeminal neuralgia, neuritis such as experimental allergic neuritis, optic neuritis, polyneuritis, polyradiculoneuritis and radiculities such as polyradiculitis, hereditary motor and sensory neuropathies such as Charcot-Marie Disease, Hereditary Optic Atrophy, Refsum's Disease, Hereditary Spastic Paraplegia and Werdnig-Hoffmann Disease, Hereditary Sensory and Autonomic Neuropathies which include Congenital Analgesia and Familial Dysautonomia, POEMS Syndrome, Sciatica, Gustatory Sweating and Tetany).

Endocrine Disorders

[0713] Polynucleotides or polypeptides, or agonists or antagonists of the present invention, may be used to treat, prevent, diagnose, and/or prognose disorders and/or diseases related to hormone imbalance, and/or disorders or diseases of the endocrine system.

[0714] Hormones secreted by the glands of the endocrine system control physical growth, sexual function, metabolism, and other functions. Disorders may be classified in two ways: disturbances in the production of hormones, and the inability of tissues to respond to hormones. The etiology of these hormone imbalance or endocrine system diseases, disorders or conditions may be genetic, somatic, such as cancer and some autoimmune diseases, acquired (e.g., by chemotherapy, injury or toxins), or infectious. Moreover, polynucleotides, polypeptides, antibodies, and/or agonists or antagonists of the present invention can be used as a marker or detector of a particular disease or disorder related to the endocrine system and/or hormone imbalance.

[0715] Endocrine system and/or hormone imbalance and/or diseases encompass disorders of uterine motility including, but not limited to: complications with pregnancy and labor (e.g., pre-term labor, post-term pregnancy, spontaneous abortion, and slow or stopped labor); and disorders and/or diseases of the menstrual cycle (e.g., dysmenorrhea and endometriosis).

[0716] Endocrine system and/or hormone imbalance disorders and/or diseases include disorders and/or diseases of the pancreas, such as, for example, diabetes mellitus, diabetes insipidus, congenital pancreatic agenesis, pheochromocytoma--islet cell tumor syndrome; disorders and/or diseases of the adrenal glands such as, for example, Addison's Disease, corticosteroid deficiency, virilizing disease, hirsutism, Cushing's Syndrome, hyperaldosteronism, pheochromocytoma; disorders and/or diseases of the pituitary gland, such as, for example, hyperpituitarism, hypopituitarism, pituitary dwarfism, pituitary adenoma, panhypopituitarism, acromegaly, gigantism; disorders and/or diseases of the thyroid, including but not limited to, hyperthyroidism, hypothyroidism, Plummer's disease, Graves' disease (toxic diffuse goiter), toxic nodular goiter, thyroiditis (Hashimoto's thyroiditis, subacute granulomatous thyroiditis, and silent lymphocytic thyroiditis), Pendred's syndrome, myxedema, cretinism, thyrotoxicosis, thyroid hormone coupling defect, thymic aplasia, Hurthle cell tumours of the thyroid, thyroid cancer, thyroid carcinoma, Medullary thyroid carcinoma; disorders and/or diseases of the parathyroid, such as, for example, hyperparathyroidism, hypoparathyroidism; disorders and/or diseases of the hypothalamus.

[0717] In addition, endocrine system and/or hormone imbalance disorders and/or diseases may also include disorders and/or diseases of the testes or ovaries, including cancer. Other disorders and/or diseases of the testes or ovaries further include, for example, ovarian cancer, polycystic ovary syndrome, Klinefelter's syndrome, vanishing testes syndrome (bilateral anorchia), congenital absence of Leydig's cells, cryptorchidism, Noonan's syndrome, myotonic dystrophy, capillary haemangioma of the testis (benign), neoplasias of the testis and neo-testis.

[0718] Moreover, endocrine system and/or hormone imbalance disorders and/or diseases may also include disorders and/or diseases such as, for example, polyglandular deficiency syndromes, pheochromocytoma, neuroblastoma, multiple Endocrine neoplasia, and disorders and/or cancers of endocrine tissues.

[0719] In another embodiment, a polypeptide of the invention, or polynucleotides, antibodies, agonists, or antagonists corresponding to that polypeptide, may be used to diagnose, prognose, prevent, and/or treat endocrine diseases and/or disorders associated with the tissue(s) in which the polypeptide of the invention is expressed, including one, two, three, four, five, or more tissues disclosed in Table 1A, column 7 (Tissue Distribution Library Code).

Gastrointestinal Disorders

[0720] Polynucleotides or polypeptides, or agonists or antagonists of the present invention, may be used to treat, prevent, diagnose, and/or prognose gastrointestinal disorders, including inflammatory diseases and/or conditions, infections, cancers (e.g., intestinal neoplasms (carcinoid tumor of the small intestine, non-Hodgkin's lymphoma of the small intestine, small bowel lymphoma)), and ulcers, such as peptic ulcers.

[0721] Gastrointestinal disorders include dysphagia, odynophagia, inflammation of the esophagus, peptic esophagitis, gastric reflux, submucosal fibrosis and stricturing, Mallory-Weiss lesions, leiomyomas, lipomas, epidermal cancers, adeoncarcinomas, gastric retention disorders, gastroenteritis, gastric atrophy, gastric/stomach cancers, polyps of the stomach, autoimmune disorders such as pernicious anemia, pyloric stenosis, gastritis (bacterial, viral, eosinophilic, stress-induced, chronic erosive, atrophic, plasma cell, and Ménétrier's), and peritoneal diseases (e.g., chyloperitoneum, hemoperitoneum, mesenteric cyst, mesenteric

lymphadenitis, mesenteric vascular occlusion, panniculitis, neoplasms, peritonitis, pneumoperitoneum, bubphrenic abscess).

[0722] Gastrointestinal disorders also include disorders associated with the small intestine, such as malabsorption syndromes, distension, irritable bowel syndrome, sugar intolerance, celiac disease, duodenal ulcers, duodenitis, tropical sprue, Whipple's disease, intestinal lymphangiectasia, Crohn's disease, appendicitis, obstructions of the ileum, Meckel's diverticulum, multiple diverticula; failure of complete rotation of the small and large intestine, lymphoma, and bacterial and parasitic diseases (such as Traveler's diarrhea, typhoid and paratyphoid, cholera, infection by Roundworms (*Ascariasis lumbricoides*), Hookworms (*Ancylostoma duodenale*), Threadworms (*Enterobius vermicularis*), Tapeworms (*Taenia saginata*, *Echinococcus granulosus*, *Diphyllobothrium spp.*, and *T. solium*).

[0723] Liver diseases and/or disorders include intrahepatic cholestasis (alagille syndrome, biliary liver cirrhosis), fatty liver (alcoholic fatty liver, reye syndrome), hepatic vein thrombosis, hepatolenticular degeneration, hepatomegaly, hepatopulmonary syndrome, hepatorenal syndrome, portal hypertension (esophageal and gastric varices), liver abscess (amebic liver abscess), liver cirrhosis (alcoholic, biliary and experimental), alcoholic liver diseases (fatty liver, hepatitis, cirrhosis), parasitic (hepatic echinococcosis, fascioliasis, amebic liver abscess), jaundice (hemolytic, hepatocellular, and cholestatic), cholestasis, portal hypertension, liver enlargement, ascites, hepatitis (alcoholic hepatitis, animal hepatitis, chronic hepatitis (autoimmune, hepatitis B, hepatitis C, hepatitis D, drug induced), toxic hepatitis, viral human hepatitis (hepatitis A, hepatitis B, hepatitis C, hepatitis D, hepatitis E), Wilson's disease, granulomatous hepatitis, secondary biliary cirrhosis, hepatic encephalopathy, portal hypertension, varices, hepatic encephalopathy, primary biliary cirrhosis, primary sclerosing cholangitis, hepatocellular adenoma, hemangiomas, bile stones, liver failure (hepatic encephalopathy, acute liver failure), and liver neoplasms (angiomyolipoma, calcified liver metastases, cystic liver metastases, epithelial tumors, fibrolamellar hepatocarcinoma, focal nodular hyperplasia, hepatic adenoma, hepatobiliary cystadenoma, hepatoblastoma, hepatocellular carcinoma, hepatoma, liver cancer, liver hemangioendothelioma, mesenchymal hamartoma, mesenchymal tumors of liver, nodular regenerative hyperplasia, benign liver tumors (Hepatic cysts [Simple

cysts, Polycystic liver disease, Hepatobiliary cystadenoma, Choledochal cyst]. Mesenchymal tumors [Mesenchymal hamartoma, Infantile hemangioendothelioma, Hemangioma, Peliosis hepatis, Lipomas, Inflammatory pseudotumor, Miscellaneous]. Epithelial tumors [Bile duct epithelium (Bile duct hamartoma, Bile duct adenoma), Hepatocyte (Adenoma, Focal nodular hyperplasia, Nodular regenerative hyperplasia)], malignant liver tumors [hepatocellular, hepatoblastoma, hepatocellular carcinoma, cholangiocellular, cholangiocarcinoma, cystadenocarcinoma, tumors of blood vessels, angiosarcoma, Kaposi's sarcoma, hemangioendothelioma, other tumors, embryonal sarcoma, fibrosarcoma, leiomyosarcoma, rhabdomyosarcoma, carcinosarcoma, teratoma, carcinoid, squamous carcinoma, primary lymphoma]), peliosis hepatis, erythrohepatic porphyria, hepatic porphyria (acute intermittent porphyria, porphyria cutanea tarda), Zellweger syndrome).

[0724] Pancreatic diseases and/or disorders include acute pancreatitis, chronic pancreatitis (acute necrotizing pancreatitis, alcoholic pancreatitis), neoplasms (adenocarcinoma of the pancreas, cystadenocarcinoma, insulinoma, gastrinoma, and glucagonoma, cystic neoplasms, islet-cell tumors, pancreoblastoma), and other pancreatic diseases (e.g., cystic fibrosis, cyst (pancreatic pseudocyst, pancreatic fistula, insufficiency)).

[0725] Gallbladder diseases include gallstones (cholelithiasis and choledocholithiasis), postcholecystectomy syndrome, diverticulosis of the gallbladder, acute cholecystitis, chronic cholecystitis, bile duct tumors, and mucocele.

[0726] Diseases and/or disorders of the large intestine include antibiotic-associated colitis, diverticulitis, ulcerative colitis, acquired megacolon, abscesses, fungal and bacterial infections, anorectal disorders (e.g., fissures, hemorrhoids), colonic diseases (colitis, colonic neoplasms [colon cancer, adenomatous colon polyps (e.g., villous adenoma), colon carcinoma, colorectal cancer], colonic diverticulitis, colonic diverticulosis, megacolon [Hirschsprung disease, toxic megacolon]; sigmoid diseases [proctocolitis, sigmoid neoplasms]), constipation, Crohn's disease, diarrhea (infantile diarrhea, dysentery), duodenal diseases (duodenal neoplasms, duodenal obstruction, duodenal ulcer, duodenitis), enteritis (enterocolitis), HIV enteropathy, ileal diseases (ileal neoplasms, ileitis), immunoproliferative small intestinal disease, inflammatory bowel disease (ulcerative colitis, Crohn's disease), intestinal atresia, parasitic diseases

(anisakiasis, balantidiasis, blastocystis infections, cryptosporidiosis, dientamoebiasis, amebic dysentery, giardiasis), intestinal fistula (rectal fistula), intestinal neoplasms (cecal neoplasms, colonic neoplasms, duodenal neoplasms, ileal neoplasms, intestinal polyps, jejunal neoplasms, rectal neoplasms), intestinal obstruction (afferent loop syndrome, duodenal obstruction, impacted feces, intestinal pseudo-obstruction [cecal volvulus], intussusception), intestinal perforation, intestinal polyps (colonic polyps, gardner syndrome, peutz-jeghers syndrome), jejunal diseases (jejunal neoplasms), malabsorption syndromes (blind loop syndrome, celiac disease, lactose intolerance, short bowel syndrome, tropical sprue, whipple's disease), mesenteric vascular occlusion, pneumatosis cystoides intestinalis, protein-losing enteropathies (intestinal lymphangiectasis), rectal diseases (anus diseases, fecal incontinence, hemorrhoids, proctitis, rectal fistula, rectal prolapse, rectocele), peptic ulcer (duodenal ulcer, peptic esophagitis, hemorrhage, perforation, stomach ulcer, Zollinger-Ellison syndrome), postgastrectomy syndromes (dumping syndrome), stomach diseases (e.g., achlorhydria, duodenogastric reflux (bile reflux), gastric antral vascular ectasia, gastric fistula, gastric outlet obstruction, gastritis (atrophic or hypertrophic), gastroparesis, stomach dilatation, stomach diverticulum, stomach neoplasms (gastric cancer, gastric polyps, gastric adenocarcinoma, hyperplastic gastric polyp), stomach rupture, stomach ulcer, stomach volvulus), tuberculosis, visceroptosis, vomiting (e.g., hematemesis, hyperemesis gravidarum, postoperative nausea and vomiting) and hemorrhagic colitis.

[0727] Further diseases and/or disorders of the gastrointestinal system include biliary tract diseases, such as, gastroschisis, fistula (e.g., biliary fistula, esophageal fistula, gastric fistula, intestinal fistula, pancreatic fistula), neoplasms (e.g., biliary tract neoplasms, esophageal neoplasms, such as adenocarcinoma of the esophagus, esophageal squamous cell carcinoma, gastrointestinal neoplasms, pancreatic neoplasms, such as adenocarcinoma of the pancreas, mucinous cystic neoplasm of the pancreas, pancreatic cystic neoplasms, pancreatoblastoma, and peritoneal neoplasms), esophageal disease (e.g., bullous diseases, candidiasis, glycogenic acanthosis, ulceration, barrett esophagus varices, atresia, cyst, diverticulum (e.g., Zenker's diverticulum), fistula (e.g., tracheoesophageal fistula), motility disorders (e.g., CREST syndrome, deglutition disorders, achalasia, spasm, gastroesophageal reflux), neoplasms, perforation (e.g., Boerhaave syndrome, Mallory-Weiss syndrome),

stenosis, esophagitis, diaphragmatic hernia (e.g., hiatal hernia); gastrointestinal diseases, such as, gastroenteritis (e.g., cholera morbus, norwalk virus infection), hemorrhage (e.g., hematemesis, melena, peptic ulcer hemorrhage), stomach neoplasms (gastric cancer, gastric polyps, gastric adenocarcinoma, stomach cancer)), hernia (e.g., congenital diaphragmatic hernia, femoral hernia, inguinal hernia, obturator hernia, umbilical hernia, ventral hernia), and intestinal diseases (e.g., cecal diseases (appendicitis, cecal neoplasms)).

Developmental and Inherited Disorders

[0728] Polynucleotides or polypeptides, or agonists or antagonists of the present invention may be used to treat, prevent, diagnose, and/or prognose diseases associated with mixed fetal tissues, including, but not limited to, developmental and inherited disorders or defects of the nervous system, musculoskeletal system, excretory system, cardiovascular system, hematopoietic system, gastrointestinal system, reproductive system, and respiratory system. Compositions of the present invention may also be used to treat, prevent, diagnose, and/or prognose developmental and inherited disorders or defects associated with, but not limited to, skin, hair, visual, and auditory tissues, metabolism. Additionally, the compositions of the invention may be useful in the diagnosis, treatment, and/or prevention of disorders or diseases associated with, but not limited to, chromosomal or genetic abnormalities and hyperproliferation or neoplasia.

[0729] Disorders or defects of the nervous system associated with developmental or inherited abnormalities that may be diagnosed, treated, and/or prevented with the compositions of the invention include, but are not limited to, adrenoleukodystrophy, agenesis of corpus callosum, Alexander disease, anencephaly, Angelman syndrome, Arnold-Chiari deformity, Batten disease, Canavan disease, cephalic disorders, Charcot-Marie-Tooth disease, encephalocele, Friedreich's ataxia, Gaucher's disease, Gorlin syndrome, Hallervorden-Spatz disease, hereditary spastic paraplegia, Huntington disease, hydranencephaly, hydrocephalus, Joubert syndrome, Lesch-Nyhan syndrome, leukodystrophy, Menkes disease, microcephaly, Niemann-Pick Type C1, neurofibromatosis, porencephaly, progeria, proteus syndrome, Refsum

disease, spina bifida, Sturge-Weber syndrome, Tay-Sachs disease, tuberous sclerosis, and von Hippel-Lindau disease.

[0730] Developmental and inherited disorders resulting in disorders or defects of the musculoskeletal system that may be diagnosed, treated, and/or prevented with the compositions of the invention include, but are not limited to, achondroplasia, atlanto-occipital fusion, arthrogryposis multiplex congenita, autosomal recessive muscular dystrophy, Becker's muscular dystrophy, cerebral palsy, choanal atresia, cleft lip, cleft palate, clubfoot, congenital amputation, congenital dislocation of the hip, congenital torticollis, congenital scoliosis, dopa-responsive dystonia, Duchenne muscular dystrophy, early-onset generalized dystonia, femoral torsion, Gorlin syndrome, hypophosphatasia, Klippel-Feil syndrome, knee dislocation, myoclonic dystonia, myotonic dystrophy, nail-patella syndrome, osteogenesis imperfecta, paroxysmal dystonia, progeria, prune-belly syndrome, rapid-onset dystonia parkinsonism, scoliosis, syndactyly, Treacher Collins' syndrome, velocardiofacial syndrome, and X-linked dystonia-parkinsonism.

[0731] Developmental or hereditary disorders or defects of the excretory system that may be diagnosed, treated, and/or prevented with the compositions of the invention include, but are not limited to, Alport's syndrome, Bartter's syndrome, bladder diverticula, bladder exstrophy, cystinuria, epispadias, Fanconi's syndrome, Hartnup disease, horseshoe kidney, hypospadias, kidney agenesis, kidney ectopia, kidney malrotation, Liddle's syndrome, medullary cystic disease, medullary sponge, multicystic kidney, kidney polycystic kidney disease, nail-patella syndrome, Potter's syndrome, urinary tract flow obstruction, vitamin D-resistant rickets, and Wilm's tumor.

[0732] Cardiovascular disorders or defects of developmental or hereditary origin that may be diagnosed, treated, and/or prevented with the compositions of the invention include, but are not limited to, aortic valve stenosis, atrial septal defects, arterioventricular (A-V) canal defect, bicuspid aortic valve, coarctation of the aorta, dextrocardia, Ebstein's anomaly, Eisenmenger's complex, hypoplastic left heart syndrome, Marfan syndrome, patent ductus arteriosus, progeria, pulmonary atresia, pulmonary valve stenosis, subaortic stenosis, tetralogy of fallot, total anomalous pulmonary venous (P-V) connection, transposition of the great arteries, tricuspid

atresia, truncus arteriosus, ventricular septal defects. Developmental or inherited disorders resulting in disorders involving the hematopoietic system that may be diagnosed, treated, and/or prevented with the compositions of the invention include, but not limited to, Bernard-Soulier syndrome, Chédiak-Higashi syndrome, hemophilia, Hermansky-Pudlak syndrome, sickle cell anemia, storage pool disease, thromboxane A2 dysfunction, thrombasthenia, and von Willebrand's disease.

[0733] The compositions of the invention may also be used to diagnose, treat, and/or prevent developmental and inherited disorders resulting in disorders or defects of the gastrointestinal system, including, but not limited to, anal atresia, biliary atresia, esophageal atresia, diaphragmatic hernia, Hirschsprung's disease, Meckel's diverticulum, oligohydramnios, omphalocele, polyhydramnios, porphyria, situs inversus viscera. Developmental or inherited disorders resulting in metabolic disorders that may be diagnosed, treated, and/or prevented with the compositions of the invention include, but are not limited to, alpha-1 antitrypsin deficiency, cystic fibrosis, hemochromatosis, lysosomal storage disease, phenylketonuria, Wilson's disease, and Zellweger syndrome.

[0734] Disorders of the reproductive system that are developmentally or hereditary related that may also be diagnosed, treated, and/or prevented with the compositions of the invention include, but are not limited to, androgen insensitivity syndrome, ambiguous genitalia, autosomal sex reversal, congenital adreneal hyperplasia, gonadoblastoma, ovarian germ cell cancer, pseudohermaphroditism, true hermaphroditism, undescended testis, XX male syndrome, and XY female type gonadal dysgenesis. The compositions of the invention may also be used to diagnose, treat, and/or prevent developmental or inherited respiratory defects including, but not limited to, askin tumor, azygos lobe, congenital diaphragmatic hernia, congenital lobar emphysema, cystic adenomatoid malformation, lobar emphysema, hyaline membrane disease, and pectus excavatum.

[0735] Developmental or inherited disorders may also result from chromosomal or genetic aberration that may be diagnosed, treated, and/or prevented with the compositions of the invention including, but not limited to, 4p- syndrome, cri du chat syndrome, Digeorge syndrome, Down's syndrome, Edward's syndrome, fragile X syndrome, Klinefelter's syndrome, Patau's syndrome, Prader-Willi syndrome,

progeria, Turner's syndrome, triple X syndrome, and XYY syndrome. Other developmental disorders that can be diagnosed, treated, and/or prevented with the compositions of the invention, include, but are not limited to, fetal alcohol syndrome, and can be caused by environmental factors surrounding the developing fetus.

[0736] The compositions of the invention may further be able to be used to diagnose, treat, and/or prevent errors in development or a genetic disposition that may result in hyperproliferative disorders or neoplasms, including, but not limited to, acute childhood lymphoblastic leukemia, askin tumor, Beckwith-Wiedemann syndrome, childhood acute myeloid leukemia, childhood brain stem glioma, childhood cerebellar astrocytoma, childhood extracranial germ cell tumors childhood (primary), gonadoblastoma, hepatocellular cancer, childhood Hodgkin's disease, childhood Hodgkin's lymphoma, childhood hypothalamic and visual pathway glioma, childhood (primary) liver cancer, childhood lymphoblastic leukemia, childhood medulloblastoma, childhood non-Hodgkin's lymphoma, childhood pineal and supratentorial primitive neuroectodermal tumors, childhood primary liver cancer, childhood rhabdomyosarcoma, childhood soft tissue sarcoma, Gorlin syndrome, familial multiple endocrine neoplasia type I, neuroblastoma, ovarian germ cell cancer, pheochromocytoma, retinoblastoma, and Wilm's tumor.

[0737] Polypeptides may be administered using any method known in the art, including, but not limited to, direct needle injection at the delivery site, intravenous injection, topical administration, catheter infusion, biolistic injectors, particle accelerators, gelfoam sponge depots, other commercially available depot materials, osmotic pumps, oral or suppository solid pharmaceutical formulations, decanting or topical applications during surgery, aerosol delivery. Such methods are known in the art. Polypeptides may be administered as part of a Therapeutic, described in more detail below. Methods of delivering polynucleotides are described in more detail herein.

Diseases at the Cellular Level

[0738] Diseases associated with increased cell survival or the inhibition of apoptosis that could be treated, prevented, diagnosed and/or prognosed using polynucleotides or polypeptides, as well as antagonists or agonists of the present

invention, include cancers (such as follicular lymphomas, carcinomas with p53 mutations, and hormone-dependent tumors, including, but not limited to colon cancer, cardiac tumors, pancreatic cancer, melanoma, retinoblastoma, glioblastoma, lung cancer, intestinal cancer, testicular cancer, stomach cancer, neuroblastoma, myxoma, myoma, lymphoma, endothelioma, osteoblastoma, osteoclastoma, osteosarcoma, chondrosarcoma, adenoma, breast cancer, prostate cancer, Kaposi's sarcoma and ovarian cancer); autoimmune disorders (such as, multiple sclerosis, Sjogren's syndrome, Hashimoto's thyroiditis, biliary cirrhosis, Behcet's disease, Crohn's disease, polymyositis, systemic lupus erythematosus and immune-related glomerulonephritis and rheumatoid arthritis) and viral infections (such as herpes viruses, pox viruses and adenoviruses), inflammation, graft v. host disease, acute graft rejection, and chronic graft rejection.

[0739] In preferred embodiments, polynucleotides, polypeptides, and/or antagonists of the invention are used to inhibit growth, progression, and/or metastasis of cancers, in particular those [listed above] involving reproductive system tissues.

[0740] Additional diseases or conditions associated with increased cell survival that could be treated or detected by polynucleotides or polypeptides, or agonists or antagonists of the present invention include, but are not limited to, progression, and/or metastases of malignancies and related disorders such as leukemia (including acute leukemias (e.g., acute lymphocytic leukemia, acute myelocytic leukemia (including myeloblastic, promyelocytic, myelomonocytic, monocytic, and erythroleukemia)) and chronic leukemias (e.g., chronic myelocytic (granulocytic) leukemia and chronic lymphocytic leukemia)), polycythemia vera, lymphomas (e.g., Hodgkin's disease and non-Hodgkin's disease), multiple myeloma, Waldenstrom's macroglobulinemia, heavy chain disease, and solid tumors including, but not limited to, sarcomas and carcinomas such as fibrosarcoma, myxosarcoma, liposarcoma, chondrosarcoma, osteogenic sarcoma, chordoma, angiosarcoma, endotheliosarcoma, lymphangiosarcoma, lymphangioendotheliosarcoma, synovioma, mesothelioma, Ewing's tumor, leiomyosarcoma, rhabdomyosarcoma, colon carcinoma, pancreatic cancer, breast cancer, ovarian cancer, prostate cancer, squamous cell carcinoma, basal cell carcinoma, adenocarcinoma, sweat gland carcinoma, sebaceous gland carcinoma, papillary carcinoma, papillary adenocarcinomas, cystadenocarcinoma, medullary

carcinoma, bronchogenic carcinoma, renal cell carcinoma, hepatoma, bile duct carcinoma, choriocarcinoma, seminoma, embryonal carcinoma, Wilm's tumor, cervical cancer, testicular tumor, lung carcinoma, small cell lung carcinoma, bladder carcinoma, epithelial carcinoma, glioma, astrocytoma, medulloblastoma, craniopharyngioma, ependymoma, pinealoma, hemangioblastoma, acoustic neuroma, oligodendroglioma, menangioma, melanoma, neuroblastoma, and retinoblastoma.

[0741] Diseases associated with increased apoptosis that could be treated, prevented, diagnosed, and/or prognosed using polynucleotides or polypeptides, as well as agonists or antagonists of the present invention, include, but are not limited to, AIDS; neurodegenerative disorders (such as Alzheimer's disease, Parkinson's disease, Amyotrophic lateral sclerosis, Retinitis pigmentosa, Cerebellar degeneration and brain tumor or prior associated disease); autoimmune disorders (such as, multiple sclerosis, Sjogren's syndrome, Hashimoto's thyroiditis, biliary cirrhosis, Behcet's disease, Crohn's disease, polymyositis, systemic lupus erythematosus and immune-related glomerulonephritis and rheumatoid arthritis) myelodysplastic syndromes (such as aplastic anemia), graft v. host disease, ischemic injury (such as that caused by myocardial infarction, stroke and reperfusion injury), liver injury (e.g., hepatitis related liver injury, ischemia/reperfusion injury, cholestasis (bile duct injury) and liver cancer); toxin-induced liver disease (such as that caused by alcohol), septic shock, cachexia and anorexia.

Wound Healing and Epithelial Cell Proliferation

[0742] In accordance with yet a further aspect of the present invention, there is provided a process for utilizing polynucleotides or polypeptides, as well as agonists or antagonists of the present invention, for therapeutic purposes, for example, to stimulate epithelial cell proliferation and basal keratinocytes for the purpose of wound healing, and to stimulate hair follicle production and healing of dermal wounds. Polynucleotides or polypeptides, as well as agonists or antagonists of the present invention, may be clinically useful in stimulating wound healing including surgical wounds, excisional wounds, deep wounds involving damage of the dermis and epidermis, eye tissue wounds, dental tissue wounds, oral cavity wounds, diabetic ulcers, dermal ulcers, cubitus ulcers, arterial ulcers, venous stasis ulcers, burns

resulting from heat exposure or chemicals, and other abnormal wound healing conditions such as uremia, malnutrition, vitamin deficiencies and complications associated with systemic treatment with steroids, radiation therapy and antineoplastic drugs and antimetabolites. Polynucleotides or polypeptides, as well as agonists or antagonists of the present invention, could be used to promote dermal reestablishment subsequent to dermal loss.

[0743] Polynucleotides or polypeptides, as well as agonists or antagonists of the present invention, could be used to increase the adherence of skin grafts to a wound bed and to stimulate re-epithelialization from the wound bed. The following are types of grafts that polynucleotides or polypeptides, agonists or antagonists of the present invention, could be used to increase adherence to a wound bed: autografts, artificial skin, allografts, autodermic graft, autoepidermic grafts, avascular grafts, Blair-Brown grafts, bone graft, brephoplastic grafts, cutis graft, delayed graft, dermic graft, epidermic graft, fascia graft, full thickness graft, heterologous graft, xenograft, homologous graft, hyperplastic graft, lamellar graft, mesh graft, mucosal graft, Ollier-Thiersch graft, omentum graft, patch graft, pedicle graft, penetrating graft, split skin graft, thick split graft. Polynucleotides or polypeptides, as well as agonists or antagonists of the present invention, can be used to promote skin strength and to improve the appearance of aged skin.

[0744] It is believed that polynucleotides or polypeptides, as well as agonists or antagonists of the present invention, will also produce changes in hepatocyte proliferation, and epithelial cell proliferation in the lung, breast, pancreas, stomach, small intestine, and large intestine. Polynucleotides or polypeptides, as well as agonists or antagonists of the present invention, could promote proliferation of epithelial cells such as sebocytes, hair follicles, hepatocytes, type II pneumocytes, mucin-producing goblet cells, and other epithelial cells and their progenitors contained within the skin, lung, liver, and gastrointestinal tract. Polynucleotides or polypeptides, agonists or antagonists of the present invention, may promote proliferation of endothelial cells, keratinocytes, and basal keratinocytes.

[0745] Polynucleotides or polypeptides, as well as agonists or antagonists of the present invention, could also be used to reduce the side effects of gut toxicity that result from radiation, chemotherapy treatments or viral infections. Polynucleotides or

polypeptides, as well as agonists or antagonists of the present invention, may have a cytoprotective effect on the small intestine mucosa. Polynucleotides or polypeptides, as well as agonists or antagonists of the present invention, may also stimulate healing of mucositis (mouth ulcers) that result from chemotherapy and viral infections.

[0746] Polynucleotides or polypeptides, as well as agonists or antagonists of the present invention, could further be used in full regeneration of skin in full and partial thickness skin defects, including burns, (i.e., repopulation of hair follicles, sweat glands, and sebaceous glands), treatment of other skin defects such as psoriasis. Polynucleotides or polypeptides, as well as agonists or antagonists of the present invention, could be used to treat epidermolysis bullosa, a defect in adherence of the epidermis to the underlying dermis which results in frequent, open and painful blisters by accelerating reepithelialization of these lesions. Polynucleotides or polypeptides, as well as agonists or antagonists of the present invention, could also be used to treat gastric and duodenal ulcers and help heal by scar formation of the mucosal lining and regeneration of glandular mucosa and duodenal mucosal lining more rapidly. Inflammatory bowel diseases, such as Crohn's disease and ulcerative colitis, are diseases, which result in destruction of the mucosal surface of the small or large intestine, respectively. Thus, polynucleotides or polypeptides, as well as agonists or antagonists of the present invention, could be used to promote the resurfacing of the mucosal surface to aid more rapid healing and to prevent progression of inflammatory bowel disease. Treatment with polynucleotides or polypeptides, agonists or antagonists of the present invention, is expected to have a significant effect on the production of mucus throughout the gastrointestinal tract and could be used to protect the intestinal mucosa from injurious substances that are ingested or following surgery. Polynucleotides or polypeptides, as well as agonists or antagonists of the present invention, could be used to treat diseases associated with the under expression.

[0747] Moreover, polynucleotides or polypeptides, as well as agonists or antagonists of the present invention, could be used to prevent and heal damage to the lungs due to various pathological states. Polynucleotides or polypeptides, as well as agonists or antagonists of the present invention, could stimulate proliferation and differentiation and promote the repair of alveoli and bronchiolar epithelium to prevent or treat acute or chronic lung damage. For example, emphysema, which results in the

progressive loss of aveoli, and inhalation injuries, i.e., resulting from smoke inhalation and burns, that cause necrosis of the bronchiolar epithelium and alveoli could be effectively treated using polynucleotides or polypeptides, agonists or antagonists of the present invention. Also, polynucleotides or polypeptides, as well as agonists or antagonists of the present invention, could be used to stimulate the proliferation of and differentiation of type II pneumocytes, which may help treat or prevent disease such as hyaline membrane diseases, such as infant respiratory distress syndrome and bronchopulmonary dysplasia, in premature infants.

[0748] Polynucleotides or polypeptides, as well as agonists or antagonists of the present invention, could stimulate the proliferation and differentiation of hepatocytes and, thus, could be used to alleviate or treat liver diseases and pathologies such as fulminant liver failure caused by cirrhosis, liver damage caused by viral hepatitis and toxic substances (i.e., acetaminophen, carbon tetrachloride and other hepatotoxins known in the art).

In addition, polynucleotides or polypeptides, as well as agonists or antagonists of the present invention, could be used to treat or prevent the onset of diabetes mellitus. In patients with newly diagnosed Types I and II diabetes, where some islet cell function remains, polynucleotides or polypeptides, as well as agonists or antagonists of the present invention, could be used to maintain the islet function so as to alleviate, delay or prevent permanent manifestation of the disease. Also, polynucleotides or polypeptides, as well as agonists or antagonists of the present invention, could be used as an auxiliary in islet cell transplantation to improve or promote islet cell function.

Infectious Diseases

[0749] Polynucleotides or polypeptides, as well as agonists or antagonists of the present invention can be used to treat or detect infectious agents. For example, by increasing the immune response, particularly increasing the proliferation and differentiation of B and/or T cells, infectious diseases may be treated. The immune response may be increased by either enhancing an existing immune response, or by initiating a new immune response. Alternatively, polynucleotides or polypeptides, as well as agonists or antagonists of the present invention may also directly inhibit the infectious agent, without necessarily eliciting an immune response.

[0750] Viruses are one example of an infectious agent that can cause disease or symptoms that can be treated or detected by a polynucleotide or polypeptide and/or agonist or antagonist of the present invention. Examples of viruses, include, but are not limited to Examples of viruses, include, but are not limited to the following DNA and RNA viruses and viral families: Arbovirus, Adenoviridae, Arenaviridae, Arterivirus, Birnaviridae, Bunyaviridae, Caliciviridae, Circoviridae, Coronaviridae, Dengue, EBV, HIV, Flaviviridae, Hepadnaviridae (Hepatitis), Herpesviridae (such as, Cytomegalovirus, Herpes Simplex, Herpes Zoster), Mononegavirus (e.g., Paramyxoviridae, Morbillivirus, Rhabdoviridae), Orthomyxoviridae (e.g., Influenza A, Influenza B, and parainfluenza), Papilloma virus, Papovaviridae, Parvoviridae, Picornaviridae, Poxviridae (such as Smallpox or Vaccinia), Reoviridae (e.g., Rotavirus), Retroviridae (HTLV-I, HTLV-II, Lentivirus), and Togaviridae (e.g., Rubivirus). Viruses falling within these families can cause a variety of diseases or symptoms, including, but not limited to: arthritis, bronchiolitis, respiratory syncytial virus, encephalitis, eye infections (e.g., conjunctivitis, keratitis), chronic fatigue syndrome, hepatitis (A, B, C, E, Chronic Active, Delta), Japanese B encephalitis, Junin, Chikungunya, Rift Valley fever, yellow fever, meningitis, opportunistic infections (e.g., AIDS), pneumonia, Burkitt's Lymphoma, chickenpox, hemorrhagic fever, Measles, Mumps, Parainfluenza, Rabies, the common cold, Polio, leukemia, Rubella, sexually transmitted diseases, skin diseases (e.g., Kaposi's, warts), and viremia. polynucleotides or polypeptides, or agonists or antagonists of the invention, can be used to treat or detect any of these symptoms or diseases. In specific embodiments, polynucleotides, polypeptides, or agonists or antagonists of the invention are used to treat: meningitis, Dengue, EBV, and/or hepatitis (e.g., hepatitis B). In an additional specific embodiment polynucleotides, polypeptides, or agonists or antagonists of the invention are used to treat patients nonresponsive to one or more other commercially available hepatitis vaccines. In a further specific embodiment polynucleotides, polypeptides, or agonists or antagonists of the invention are used to treat AIDS.

[0751] Similarly, bacterial and fungal agents that can cause disease or symptoms and that can be treated or detected by a polynucleotide or polypeptide and/or agonist or antagonist of the present invention include, but not limited to, the following Gram-

Negative and Gram-positive bacteria, bacterial families, and fungi: Actinomyces (e.g., Norcardia), Acinetobacter, *Cryptococcus neoformans*, Aspergillus, Bacillaceae (e.g., *Bacillus anthracis*), Bacteroides (e.g., *Bacteroides fragilis*), Blastomycosis, Bordetella, Borrelia (e.g., *Borrelia burgdorferi*), Brucella, Candidia, Campylobacter, Chlamydia, Clostridium (e.g., *Clostridium botulinum*, *Clostridium difficile*, *Clostridium perfringens*, *Clostridium tetani*), Coccidioides, Corynebacterium (e.g., *Corynebacterium diphtheriae*), Cryptococcus, Dermatocycoses, *E. coli* (e.g., Enterotoxigenic *E. coli* and Enterohemorrhagic *E. coli*), Enterobacter (e.g., *Enterobacter aerogenes*), Enterobacteriaceae (Klebsiella, Salmonella (e.g., *Salmonella typhi*, *Salmonella enteritidis*, *Salmonella typhi*), Serratia, Yersinia, Shigella), Erysipelothrix, Haemophilus (e.g., *Haemophilus influenza* type B), Helicobacter, Legionella (e.g., *Legionella pneumophila*), Leptospira, Listeria (e.g., *Listeria monocytogenes*), Mycoplasma, Mycobacterium (e.g., *Mycobacterium leprae* and *Mycobacterium tuberculosis*), Vibrio (e.g., *Vibrio cholerae*), Neisseriaceae (e.g., *Neisseria gonorrhea*, *Neisseria meningitidis*), Pasteurellaceae, Proteus, Pseudomonas (e.g., *Pseudomonas aeruginosa*), Rickettsiaceae, Spirochetes (e.g., Treponema spp., Leptospira spp., Borrelia spp.), Shigella spp., Staphylococcus (e.g., *Staphylococcus aureus*), Meningioccus, Pneumococcus and Streptococcus (e.g., *Streptococcus pneumoniae* and Groups A, B, and C Streptococci), and Ureaplasmas. These bacterial, parasitic, and fungal families can cause diseases or symptoms, including, but not limited to: antibiotic-resistant infections, bacteremia, endocarditis, septicemia, eye infections (e.g., conjunctivitis), uveitis, tuberculosis, gingivitis, bacterial diarrhea, opportunistic infections (e.g., AIDS related infections), paronychia, prosthesis-related infections, dental caries, Reiter's Disease, respiratory tract infections, such as Whooping Cough or Empyema, sepsis, Lyme Disease, Cat-Scratch Disease, dysentery, paratyphoid fever, food poisoning, Legionella disease, chronic and acute inflammation, erythema, yeast infections, typhoid, pneumonia, gonorrhea, meningitis (e.g., meningitis types A and B), chlamydia, syphilis, diphtheria, leprosy, brucellosis, peptic ulcers, anthrax, spontaneous abortions, birth defects, pneumonia, lung infections, ear infections, deafness, blindness, lethargy, malaise, vomiting, chronic diarrhea, Crohn's disease, colitis, vaginosis, sterility, pelvic inflammatory diseases, candidiasis, paratuberculosis, tuberculosis, lupus, botulism, gangrene, tetanus,

impetigo, Rheumatic Fever, Scarlet Fever, sexually transmitted diseases, skin diseases (e.g., cellulitis, dermatocycoses), toxemia, urinary tract infections, wound infections, noscomial infections. Polynucleotides or polypeptides, agonists or antagonists of the invention, can be used to treat or detect any of these symptoms or diseases. In specific embodiments, polynucleotides, polypeptides, agonists or antagonists of the invention are used to treat: tetanus, diphtheria, botulism, and/or meningitis type B.

[0752] Moreover, parasitic agents causing disease or symptoms that can be treated, prevented, and/or diagnosed by a polynucleotide or polypeptide and/or agonist or antagonist of the present invention include, but not limited to, the following families or class: Amebiasis, Babesiosis, Coccidiosis, Cryptosporidiosis, Dientamoebiasis, Dourine, Ectoparasitic, Giardiasis, Helminthiasis, Leishmaniasis, Schistosoma, Theileriasis, Toxoplasmosis, Trypanosomiasis, and Trichomonas and Sporozoans (e.g., *Plasmodium virax*, *Plasmodium falciparum*, *Plasmodium malariae* and *Plasmodium ovale*). These parasites can cause a variety of diseases or symptoms, including, but not limited to: Scabies, Trombiculiasis, eye infections, intestinal disease (e.g., dysentery, giardiasis), liver disease, lung disease, opportunistic infections (e.g., AIDS related), malaria, pregnancy complications, and toxoplasmosis. polynucleotides or polypeptides, or agonists or antagonists of the invention, can be used to treat, prevent, and/or diagnose any of these symptoms or diseases. In specific embodiments, polynucleotides, polypeptides, or agonists or antagonists of the invention are used to treat, prevent, and/or diagnose malaria.

[0753] Polynucleotides or polypeptides, as well as agonists or antagonists of the present invention of the present invention could either be by administering an effective amount of a polypeptide to the patient, or by removing cells from the patient, supplying the cells with a polynucleotide of the present invention, and returning the engineered cells to the patient (ex vivo therapy). Moreover, the polypeptide or polynucleotide of the present invention can be used as an antigen in a vaccine to raise an immune response against infectious disease.

Regeneration

[0754] Polynucleotides or polypeptides, as well as agonists or antagonists of the present invention can be used to differentiate, proliferate, and attract cells, leading to

the regeneration of tissues. (See, Science 276:59-87 (1997).) The regeneration of tissues could be used to repair, replace, or protect tissue damaged by congenital defects, trauma (wounds, burns, incisions, or ulcers), age, disease (e.g. osteoporosis, osteoarthritis, periodontal disease, liver failure), surgery, including cosmetic plastic surgery, fibrosis, reperfusion injury, or systemic cytokine damage.

[0755] Tissues that could be regenerated using the present invention include organs (e.g., pancreas, liver, intestine, kidney, skin, endothelium), muscle (smooth, skeletal or cardiac), vasculature (including vascular and lymphatics), nervous, hematopoietic, and skeletal (bone, cartilage, tendon, and ligament) tissue. Preferably, regeneration occurs without or decreased scarring. Regeneration also may include angiogenesis.

[0756] Moreover, polynucleotides or polypeptides, as well as agonists or antagonists of the present invention, may increase regeneration of tissues difficult to heal. For example, increased tendon/ligament regeneration would quicken recovery time after damage. Polynucleotides or polypeptides, as well as agonists or antagonists of the present invention could also be used prophylactically in an effort to avoid damage. Specific diseases that could be treated include of tendinitis, carpal tunnel syndrome, and other tendon or ligament defects. A further example of tissue regeneration of non-healing wounds includes pressure ulcers, ulcers associated with vascular insufficiency, surgical, and traumatic wounds.

[0757] Similarly, nerve and brain tissue could also be regenerated by using polynucleotides or polypeptides, as well as agonists or antagonists of the present invention, to proliferate and differentiate nerve cells. Diseases that could be treated using this method include central and peripheral nervous system diseases, neuropathies, or mechanical and traumatic disorders (e.g., spinal cord disorders, head trauma, cerebrovascular disease, and stroke). Specifically, diseases associated with peripheral nerve injuries, peripheral neuropathy (e.g., resulting from chemotherapy or other medical therapies), localized neuropathies, and central nervous system diseases (e.g., Alzheimer's disease, Parkinson's disease, Huntington's disease, amyotrophic lateral sclerosis, and Shy-Drager syndrome), could all be treated using the polynucleotides or polypeptides, as well as agonists or antagonists of the present invention.

Chemotaxis

[0758] Polynucleotides or polypeptides, as well as agonists or antagonists of the present invention may have chemotaxis activity. A chemotactic molecule attracts or mobilizes cells (e.g., monocytes, fibroblasts, neutrophils, T-cells, mast cells, eosinophils, epithelial and/or endothelial cells) to a particular site in the body, such as inflammation, infection, or site of hyperproliferation. The mobilized cells can then fight off and/or heal the particular trauma or abnormality.

[0759] Polynucleotides or polypeptides, as well as agonists or antagonists of the present invention may increase chemotactic activity of particular cells. These chemotactic molecules can then be used to treat inflammation, infection, hyperproliferative disorders, or any immune system disorder by increasing the number of cells targeted to a particular location in the body. For example, chemotactic molecules can be used to treat wounds and other trauma to tissues by attracting immune cells to the injured location. Chemotactic molecules of the present invention can also attract fibroblasts, which can be used to treat wounds.

[0760] It is also contemplated that polynucleotides or polypeptides, as well as agonists or antagonists of the present invention may inhibit chemotactic activity. These molecules could also be used to treat disorders. Thus, polynucleotides or polypeptides, as well as agonists or antagonists of the present invention could be used as an inhibitor of chemotaxis.

Binding Activity

[0761] A polypeptide of the present invention may be used to screen for molecules that bind to the polypeptide or for molecules to which the polypeptide binds. The binding of the polypeptide and the molecule may activate (agonist), increase, inhibit (antagonist), or decrease activity of the polypeptide or the molecule bound. Examples of such molecules include antibodies, oligonucleotides, proteins (e.g., receptors), or small molecules.

[0762] Preferably, the molecule is closely related to the natural ligand of the polypeptide, e.g., a fragment of the ligand, or a natural substrate, a ligand, a structural or functional mimetic. (See, Coligan et al., Current Protocols in Immunology

1(2):Chapter 5 (1991).) Similarly, the molecule can be closely related to the natural receptor to which the polypeptide binds, or at least, a fragment of the receptor capable of being bound by the polypeptide (e.g., active site). In either case, the molecule can be rationally designed using known techniques.

[0763] Preferably, the screening for these molecules involves producing appropriate cells which express the polypeptide. Preferred cells include cells from mammals, yeast, *Drosophila*, or *E. coli*. Cells expressing the polypeptide (or cell membrane containing the expressed polypeptide) are then preferably contacted with a test compound potentially containing the molecule to observe binding, stimulation, or inhibition of activity of either the polypeptide or the molecule.

[0764] The assay may simply test binding of a candidate compound to the polypeptide, wherein binding is detected by a label, or in an assay involving competition with a labeled competitor. Further, the assay may test whether the candidate compound results in a signal generated by binding to the polypeptide.

[0765] Alternatively, the assay can be carried out using cell-free preparations, polypeptide/molecule affixed to a solid support, chemical libraries, or natural product mixtures. The assay may also simply comprise the steps of mixing a candidate compound with a solution containing a polypeptide, measuring polypeptide/molecule activity or binding, and comparing the polypeptide/molecule activity or binding to a standard.

[0766] Preferably, an ELISA assay can measure polypeptide level or activity in a sample (e.g., biological sample) using a monoclonal or polyclonal antibody. The antibody can measure polypeptide level or activity by either binding, directly or indirectly, to the polypeptide or by competing with the polypeptide for a substrate.

[0767] Additionally, the receptor to which the polypeptide of the present invention binds can be identified by numerous methods known to those of skill in the art, for example, ligand panning and FACS sorting (Coligan, et al., Current Protocols in Immun., 1(2), Chapter 5, (1991)). For example, expression cloning is employed wherein polyadenylated RNA is prepared from a cell responsive to the polypeptides, for example, NIH3T3 cells which are known to contain multiple receptors for the FGF family proteins, and SC-3 cells, and a cDNA library created from this RNA is divided into pools and used to transfect COS cells or other cells that are not responsive to the

polypeptides. Transfected cells which are grown on glass slides are exposed to the polypeptide of the present invention, after they have been labeled. The polypeptides can be labeled by a variety of means including iodination or inclusion of a recognition site for a site-specific protein kinase.

[0768] Following fixation and incubation, the slides are subjected to autoradiographic analysis. Positive pools are identified and sub-pools are prepared and re-transfected using an iterative sub-pooling and re-screening process, eventually yielding a single clones that encodes the putative receptor.

[0769] As an alternative approach for receptor identification, the labeled polypeptides can be photoaffinity linked with cell membrane or extract preparations that express the receptor molecule. Cross-linked material is resolved by PAGE analysis and exposed to X-ray film. The labeled complex containing the receptors of the polypeptides can be excised, resolved into peptide fragments, and subjected to protein microsequencing. The amino acid sequence obtained from microsequencing would be used to design a set of degenerate oligonucleotide probes to screen a cDNA library to identify the genes encoding the putative receptors.

[0770] Moreover, the techniques of gene-shuffling, motif-shuffling, exon-shuffling, and/or codon-shuffling (collectively referred to as "DNA shuffling") may be employed to modulate the activities of the polypeptide of the present invention thereby effectively generating agonists and antagonists of the polypeptide of the present invention. *See generally*, U.S. Patent Nos. 5,605,793, 5,811,238, 5,830,721, 5,834,252, and 5,837,458, and Patten, P. A., et al., *Curr. Opinion Biotechnol.* 8:724-33 (1997); Harayama, S. *Trends Biotechnol.* 16(2):76-82 (1998); Hansson L. O., et al., *J. Mol. Biol.* 287:265-76 (1999); and Lorenzo, M. M. and Blasco, R. *Biotechniques* 24(2):308-13 (1998); each of these patents and publications are hereby incorporated by reference). In one embodiment, alteration of polynucleotides and corresponding polypeptides may be achieved by DNA shuffling. DNA shuffling involves the assembly of two or more DNA segments into a desired molecule by homologous, or site-specific, recombination. In another embodiment, polynucleotides and corresponding polypeptides may be altered by being subjected to random mutagenesis by error-prone PCR, random nucleotide insertion or other methods prior to recombination. In another embodiment, one or more components, motifs, sections,

parts, domains, fragments, etc., of the polypeptide of the present invention may be recombined with one or more components, motifs, sections, parts, domains, fragments, etc. of one or more heterologous molecules. In preferred embodiments, the heterologous molecules are family members. In further preferred embodiments, the heterologous molecule is a growth factor such as, for example, platelet-derived growth factor (PDGF), insulin-like growth factor (IGF-I), transforming growth factor (TGF)-alpha, epidermal growth factor (EGF), fibroblast growth factor (FGF), TGF-beta, bone morphogenetic protein (BMP)-2, BMP-4, BMP-5, BMP-6, BMP-7, activins A and B, decapentaplegic(dpp), 60A, OP-2, dorsalin, growth differentiation factors (GDFs), nodal, MIS, inhibin-alpha, TGF-beta1, TGF-beta2, TGF-beta3, TGF-beta5, and glial-derived neurotrophic factor (GDNF).

[0771] Other preferred fragments are biologically active fragments of the polypeptide of the present invention. Biologically active fragments are those exhibiting activity similar, but not necessarily identical, to an activity of the polypeptide of the present invention. The biological activity of the fragments may include an improved desired activity, or a decreased undesirable activity.

[0772] Additionally, this invention provides a method of screening compounds to identify those which modulate the action of the polypeptide of the present invention. An example of such an assay comprises combining a mammalian fibroblast cell, the polypeptide of the present invention, the compound to be screened and $^3\text{[H]}$ thymidine under cell culture conditions where the fibroblast cell would normally proliferate. A control assay may be performed in the absence of the compound to be screened and compared to the amount of fibroblast proliferation in the presence of the compound to determine if the compound stimulates proliferation by determining the uptake of $^3\text{[H]}$ thymidine in each case. The amount of fibroblast cell proliferation is measured by liquid scintillation chromatography which measures the incorporation of $^3\text{[H]}$ thymidine. Both agonist and antagonist compounds may be identified by this procedure.

[0773] In another method, a mammalian cell or membrane preparation expressing a receptor for a polypeptide of the present invention is incubated with a labeled polypeptide of the present invention in the presence of the compound. The ability of

the compound to enhance or block this interaction could then be measured. Alternatively, the response of a known second messenger system following interaction of a compound to be screened and the receptor is measured and the ability of the compound to bind to the receptor and elicit a second messenger response is measured to determine if the compound is a potential agonist or antagonist. Such second messenger systems include but are not limited to, cAMP guanylate cyclase, ion channels or phosphoinositide hydrolysis.

[0774] All of these above assays can be used as diagnostic or prognostic markers. The molecules discovered using these assays can be used to treat disease or to bring about a particular result in a patient (e.g., blood vessel growth) by activating or inhibiting the polypeptide/molecule. Moreover, the assays can discover agents which may inhibit or enhance the production of the polypeptides of the invention from suitably manipulated cells or tissues.

[0775] Therefore, the invention includes a method of identifying compounds which bind to a polypeptide of the invention comprising the steps of: (a) incubating a candidate binding compound with a polypeptide of the present invention; and (b) determining if binding has occurred. Moreover, the invention includes a method of identifying agonists/antagonists comprising the steps of: (a) incubating a candidate compound with a polypeptide of the present invention, (b) assaying a biological activity, and (b) determining if a biological activity of the polypeptide has been altered.

Targeted Delivery

[0776] In another embodiment, the invention provides a method of delivering compositions to targeted cells expressing a receptor for a polypeptide of the invention, or cells expressing a cell bound form of a polypeptide of the invention.

[0777] As discussed herein, polypeptides or antibodies of the invention may be associated with heterologous polypeptides, heterologous nucleic acids, toxins, or prodrugs via hydrophobic, hydrophilic, ionic and/or covalent interactions. In one embodiment, the invention provides a method for the specific delivery of compositions of the invention to cells by administering polypeptides of the invention (including antibodies) that are associated with heterologous polypeptides or nucleic acids. In one

example, the invention provides a method for delivering a therapeutic protein into the targeted cell. In another example, the invention provides a method for delivering a single stranded nucleic acid (e.g., antisense or ribozymes) or double stranded nucleic acid (e.g., DNA that can integrate into the cell's genome or replicate episomally and that can be transcribed) into the targeted cell.

[0778] In another embodiment, the invention provides a method for the specific destruction of cells (e.g., the destruction of tumor cells) by administering polypeptides of the invention (e.g., polypeptides of the invention or antibodies of the invention) in association with toxins or cytotoxic prodrugs.

[0779] By "toxin" is meant compounds that bind and activate endogenous cytotoxic effector systems, radioisotopes, holotoxins, modified toxins, catalytic subunits of toxins, or any molecules or enzymes not normally present in or on the surface of a cell that under defined conditions cause the cell's death. Toxins that may be used according to the methods of the invention include, but are not limited to, radioisotopes known in the art, compounds such as, for example, antibodies (or complement fixing containing portions thereof) that bind an inherent or induced endogenous cytotoxic effector system, thymidine kinase, endonuclease, RNase, alpha toxin, ricin, abrin, *Pseudomonas* exotoxin A, diphtheria toxin, saporin, momordin, gelonin, pokeweed antiviral protein, alpha-sarcin and cholera toxin. By "cytotoxic prodrug" is meant a non-toxic compound that is converted by an enzyme, normally present in the cell, into a cytotoxic compound. Cytotoxic prodrugs that may be used according to the methods of the invention include, but are not limited to, glutamyl derivatives of benzoic acid mustard alkylating agent, phosphate derivatives of etoposide or mitomycin C, cytosine arabinoside, daunorubisin, and phenoxyacetamide derivatives of doxorubicin.

Drug Screening

[0780] Further contemplated is the use of the polypeptides of the present invention, or the polynucleotides encoding these polypeptides, to screen for molecules which modify the activities of the polypeptides of the present invention. Such a method would include contacting the polypeptide of the present invention with a selected compound(s) suspected of having antagonist or agonist activity, and assaying

the activity of these polypeptides following binding.

[0781] This invention is particularly useful for screening therapeutic compounds by using the polypeptides of the present invention, or binding fragments thereof, in any of a variety of drug screening techniques. The polypeptide or fragment employed in such a test may be affixed to a solid support, expressed on a cell surface, free in solution, or located intracellularly. One method of drug screening utilizes eukaryotic or prokaryotic host cells which are stably transformed with recombinant nucleic acids expressing the polypeptide or fragment. Drugs are screened against such transformed cells in competitive binding assays. One may measure, for example, the formulation of complexes between the agent being tested and a polypeptide of the present invention.

[0782] Thus, the present invention provides methods of screening for drugs or any other agents which affect activities mediated by the polypeptides of the present invention. These methods comprise contacting such an agent with a polypeptide of the present invention or a fragment thereof and assaying for the presence of a complex between the agent and the polypeptide or a fragment thereof, by methods well known in the art. In such a competitive binding assay, the agents to screen are typically labeled. Following incubation, free agent is separated from that present in bound form, and the amount of free or uncomplexed label is a measure of the ability of a particular agent to bind to the polypeptides of the present invention.

[0783] Another technique for drug screening provides high throughput screening for compounds having suitable binding affinity to the polypeptides of the present invention, and is described in great detail in European Patent Application 84/03564, published on September 13, 1984, which is incorporated herein by reference herein. Briefly stated, large numbers of different small peptide test compounds are synthesized on a solid substrate, such as plastic pins or some other surface. The peptide test compounds are reacted with polypeptides of the present invention and washed. Bound polypeptides are then detected by methods well known in the art. Purified polypeptides are coated directly onto plates for use in the aforementioned drug screening techniques. In addition, non-neutralizing antibodies may be used to capture the peptide and immobilize it on the solid support.

[0784] This invention also contemplates the use of competitive drug screening assays in which neutralizing antibodies capable of binding polypeptides of the present

invention specifically compete with a test compound for binding to the polypeptides or fragments thereof. In this manner, the antibodies are used to detect the presence of any peptide which shares one or more antigenic epitopes with a polypeptide of the invention.

Antisense And Ribozyme (Antagonists)

[0785] In specific embodiments, antagonists according to the present invention are nucleic acids corresponding to the sequences contained in SEQ ID NO:X, or the complementary strand thereof, and/or to cDNA sequences contained in cDNA Clone ID NO:Z identified for example, in Table 1A. In one embodiment, antisense sequence is generated internally, by the organism, in another embodiment, the antisense sequence is separately administered (see, for example, O'Connor, J., *Neurochem.* 56:560 (1991). *Oligodeoxynucleotides as Antisense Inhibitors of Gene Expression*, CRC Press, Boca Raton, FL (1988). Antisense technology can be used to control gene expression through antisense DNA or RNA, or through triple-helix formation. Antisense techniques are discussed for example, in Okano, J., *Neurochem.* 56:560 (1991); *Oligodeoxynucleotides as Antisense Inhibitors of Gene Expression*, CRC Press, Boca Raton, FL (1988). Triple helix formation is discussed in, for instance, Lee et al., *Nucleic Acids Research* 6:3073 (1979); Cooney et al., *Science* 241:456 (1988); and Dervan et al., *Science* 251:1300 (1991). The methods are based on binding of a polynucleotide to a complementary DNA or RNA.

[0786] For example, the use of c-myc and c-myb antisense RNA constructs to inhibit the growth of the non-lymphocytic leukemia cell line HL-60 and other cell lines was previously described. (Wickstrom et al. (1988); Anfossi et al. (1989)). These experiments were performed *in vitro* by incubating cells with the oligoribonucleotide. A similar procedure for *in vivo* use is described in WO 91/15580. Briefly, a pair of oligonucleotides for a given antisense RNA is produced as follows: A sequence complimentary to the first 15 bases of the open reading frame is flanked by an EcoRI site on the 5' end and a HindIII site on the 3' end. Next, the pair of oligonucleotides is heated at 90°C for one minute and then annealed in 2X ligation buffer (20mM TRIS HCl pH 7.5, 10mM MgCl₂, 10mM dithiothreitol (DTT)

and 0.2 mM ATP) and then ligated to the EcoR1/Hind III site of the retroviral vector PMV7 (WO 91/15580).

[0787] For example, the 5' coding portion of a polynucleotide that encodes the polypeptide of the present invention may be used to design an antisense RNA oligonucleotide of from about 10 to 40 base pairs in length. A DNA oligonucleotide is designed to be complementary to a region of the gene involved in transcription thereby preventing transcription and the production of the receptor. The antisense RNA oligonucleotide hybridizes to the mRNA *in vivo* and blocks translation of the mRNA molecule into receptor polypeptide.

[0788] In one embodiment, the antisense nucleic acid of the invention is produced intracellularly by transcription from an exogenous sequence. For example, a vector or a portion thereof, is transcribed, producing an antisense nucleic acid (RNA) of the invention. Such a vector would contain a sequence encoding the antisense nucleic acid. Such a vector can remain episomal or become chromosomally integrated, as long as it can be transcribed to produce the desired antisense RNA. Such vectors can be constructed by recombinant DNA technology methods standard in the art. Vectors can be plasmid, viral, or others known in the art, used for replication and expression in vertebrate cells. Expression of the sequence encoding the polypeptide of the present invention or fragments thereof, can be by any promoter known in the art to act in vertebrate, preferably human cells. Such promoters can be inducible or constitutive. Such promoters include, but are not limited to, the SV40 early promoter region (Bernoist and Chambon, Nature 29:304-310 (1981)), the promoter contained in the 3' long terminal repeat of Rous sarcoma virus (Yamamoto et al., Cell 22:787-797 (1980)), the herpes thymidine promoter (Wagner et al., Proc. Natl. Acad. Sci. U.S.A. 78:1441-1445 (1981)), the regulatory sequences of the metallothionein gene (Brinster, et al., Nature 296:39-42 (1982)), etc.

[0789] The antisense nucleic acids of the invention comprise a sequence complementary to at least a portion of an RNA transcript of a gene of the present invention. However, absolute complementarity, although preferred, is not required. A sequence "complementary to at least a portion of an RNA," referred to herein, means a sequence having sufficient complementarity to be able to hybridize with the RNA, forming a stable duplex; in the case of double stranded antisense nucleic acids, a single

strand of the duplex DNA may thus be tested, or triplex formation may be assayed. The ability to hybridize will depend on both the degree of complementarity and the length of the antisense nucleic acid. Generally, the larger the hybridizing nucleic acid, the more base mismatches with a RNA it may contain and still form a stable duplex (or triplex as the case may be). One skilled in the art can ascertain a tolerable degree of mismatch by use of standard procedures to determine the melting point of the hybridized complex.

[0790] Oligonucleotides that are complementary to the 5' end of the message, e.g., the 5' untranslated sequence up to and including the AUG initiation codon, should work most efficiently at inhibiting translation. However, sequences complementary to the 3' untranslated sequences of mRNAs have been shown to be effective at inhibiting translation of mRNAs as well. See generally, Wagner, R., 1994, *Nature* 372:333-335. Thus, oligonucleotides complementary to either the 5'- or 3'- non- translated, non-coding regions of polynucleotide sequences described herein could be used in an antisense approach to inhibit translation of endogenous mRNA. Oligonucleotides complementary to the 5' untranslated region of the mRNA should include the complement of the AUG start codon. Antisense oligonucleotides complementary to mRNA coding regions are less efficient inhibitors of translation but could be used in accordance with the invention. Whether designed to hybridize to the 5', 3'- or coding region of mRNA of the present invention, antisense nucleic acids should be at least six nucleotides in length, and are preferably oligonucleotides ranging from 6 to about 50 nucleotides in length. In specific aspects the oligonucleotide is at least 10 nucleotides, at least 17 nucleotides, at least 25 nucleotides or at least 50 nucleotides.

[0791] The polynucleotides of the invention can be DNA or RNA or chimeric mixtures or derivatives or modified versions thereof, single-stranded or double-stranded. The oligonucleotide can be modified at the base moiety, sugar moiety, or phosphate backbone, for example, to improve stability of the molecule, hybridization, etc. The oligonucleotide may include other appended groups such as peptides (e.g., for targeting host cell receptors *in vivo*), or agents facilitating transport across the cell membrane (see, e.g., Letsinger et al., 1989, *Proc. Natl. Acad. Sci. U.S.A.* 86:6553-6556; Lemaitre et al., 1987, *Proc. Natl. Acad. Sci.* 84:648-652; PCT Publication No. WO88/09810, published December 15, 1988) or the blood-brain barrier (see, e.g., PCT

Publication No. WO89/10134, published April 25, 1988), hybridization-triggered cleavage agents. (See, e.g., Krol et al., 1988, BioTechniques 6:958-976) or intercalating agents. (See, e.g., Zon, 1988, Pharm. Res. 5:539-549). To this end, the oligonucleotide may be conjugated to another molecule, e.g., a peptide, hybridization triggered cross-linking agent, transport agent, hybridization-triggered cleavage agent, etc.

[0792] The antisense oligonucleotide may comprise at least one modified base moiety which is selected from the group including, but not limited to, 5-fluorouracil, 5-bromouracil, 5-chlorouracil, 5-iodouracil, hypoxanthine, xantine, 4-acetylcytosine, 5-(carboxyhydroxymethyl) uracil, 5-carboxymethylaminomethyl-2-thiouridine, 5-carboxymethylaminomethyluracil, dihydrouracil, beta-D-galactosylqueosine, inosine, N6-isopentenyladenine, 1-methylguanine, 1-methylinosine, 2,2-dimethylguanine, 2-methyladenine, 2-methylguanine, 3-methylcytosine, 5-methylcytosine, N6-adenine, 7-methylguanine, 5-methylaminomethyluracil, 5-methoxyaminomethyl-2-thiouracil, beta-D-mannosylqueosine, 5'-methoxycarboxymethyluracil, 5-methoxyuracil, 2-methylthio-N6-isopentenyladenine, uracil-5-oxyacetic acid (v), wybutoxosine, pseudouracil, queosine, 2-thiocytosine, 5-methyl-2-thiouracil, 2-thiouracil, 4-thiouracil, 5-methyluracil, uracil-5-oxyacetic acid methylester, uracil-5-oxyacetic acid (v), 5-methyl-2-thiouracil, 3-(3-amino-3-N-2-carboxypropyl) uracil, (acp3)w, and 2,6-diaminopurine.

[0793] The antisense oligonucleotide may also comprise at least one modified sugar moiety selected from the group including, but not limited to, arabinose, 2-fluoroarabinose, xylulose, and hexose.

[0794] In yet another embodiment, the antisense oligonucleotide comprises at least one modified phosphate backbone selected from the group including, but not limited to, a phosphorothioate, a phosphorodithioate, a phosphoramidothioate, a phosphoramidate, a phosphordiamidate, a methylphosphonate, an alkyl phosphotriester, and a formacetal or analog thereof.

[0795] In yet another embodiment, the antisense oligonucleotide is an a-anomeric oligonucleotide. An a-anomeric oligonucleotide forms specific double-stranded hybrids with complementary RNA in which, contrary to the usual b-units, the strands run parallel to each other (Gautier et al., 1987, Nucl. Acids Res. 15:6625-6641). The

oligonucleotide is a 2'-O-methylribonucleotide (Inoue et al., 1987, Nucl. Acids Res. 15:6131-6148), or a chimeric RNA-DNA analogue (Inoue et al., 1987, FEBS Lett. 215:327-330).

[0796] Polynucleotides of the invention may be synthesized by standard methods known in the art, e.g. by use of an automated DNA synthesizer (such as are commercially available from Biosearch, Applied Biosystems, etc.). As examples, phosphorothioate oligonucleotides may be synthesized by the method of Stein et al. (1988, Nucl. Acids Res. 16:3209), methylphosphonate oligonucleotides can be prepared by use of controlled pore glass polymer supports (Sarin et al., 1988, Proc. Natl. Acad. Sci. U.S.A. 85:7448-7451), etc.

[0797] While antisense nucleotides complementary to the coding region sequence could be used, those complementary to the transcribed untranslated region are most preferred.

[0798] Potential antagonists according to the invention also include catalytic RNA, or a ribozyme (See, e.g., PCT International Publication WO 90/11364, published October 4, 1990; Sarver et al, Science 247:1222-1225 (1990). While ribozymes that cleave mRNA at site specific recognition sequences can be used to destroy mRNAs, the use of hammerhead ribozymes is preferred. Hammerhead ribozymes cleave mRNAs at locations dictated by flanking regions that form complementary base pairs with the target mRNA. The sole requirement is that the target mRNA have the following sequence of two bases: 5'-UG-3'. The construction and production of hammerhead ribozymes is well known in the art and is described more fully in Haseloff and Gerlach, Nature 334:585-591 (1988). There are numerous potential hammerhead ribozyme cleavage sites within the nucleotide sequence of SEQ ID NO:X. Preferably, the ribozyme is engineered so that the cleavage recognition site is located near the 5' end of the mRNA; i.e., to increase efficiency and minimize the intracellular accumulation of non-functional mRNA transcripts.

[0799] As in the antisense approach, the ribozymes of the invention can be composed of modified oligonucleotides (e.g. for improved stability, targeting, etc.) and should be delivered to cells which express *in vivo*. DNA constructs encoding the ribozyme may be introduced into the cell in the same manner as described above for the introduction of antisense encoding DNA. A preferred method of delivery involves

using a DNA construct "encoding" the ribozyme under the control of a strong constitutive promoter, such as, for example, pol III or pol II promoter, so that transfected cells will produce sufficient quantities of the ribozyme to destroy endogenous messages and inhibit translation. Since ribozymes unlike antisense molecules, are catalytic, a lower intracellular concentration is required for efficiency.

[0800] Antagonist/agonist compounds may be employed to inhibit the cell growth and proliferation effects of the polypeptides of the present invention on neoplastic cells and tissues, i.e. stimulation of angiogenesis of tumors, and, therefore, retard or prevent abnormal cellular growth and proliferation, for example, in tumor formation or growth.

[0801] The antagonist/agonist may also be employed to prevent hyper-vascular diseases, and prevent the proliferation of epithelial lens cells after extracapsular cataract surgery. Prevention of the mitogenic activity of the polypeptides of the present invention may also be desirable in cases such as restenosis after balloon angioplasty.

[0802] The antagonist/agonist may also be employed to prevent the growth of scar tissue during wound healing.

[0803] The antagonist/agonist may also be employed to treat the diseases described herein.

[0804] Thus, the invention provides a method of treating disorders or diseases, including but not limited to the disorders or diseases listed throughout this application, associated with overexpression of a polynucleotide of the present invention by administering to a patient (a) an antisense molecule directed to the polynucleotide of the present invention, and/or (b) a ribozyme directed to the polynucleotide of the present invention.

Binding Peptides and Other Molecules

[0805] The invention also encompasses screening methods for identifying polypeptides and nonpolypeptides that bind reproductive system related antigen polypeptides, and the reproductive system related antigen binding molecules identified thereby. These binding molecules are useful, for example, as agonists and antagonists of the reproductive system related antigen polypeptides. Such agonists and

antagonists can be used, in accordance with the invention, in the therapeutic embodiments described in detail, below.

[0806] This method comprises the steps of: contacting reproductive system related antigen polypeptides or reproductive system related antigen-like polypeptides with a plurality of molecules; and identifying a molecule that binds the reproductive system related antigen polypeptides or reproductive system related antigen-like polypeptides.

[0807] The step of contacting the reproductive system related antigen polypeptides or reproductive system related antigen-like polypeptides with the plurality of molecules may be effected in a number of ways. For example, one may contemplate immobilizing the reproductive system related antigen polypeptides or reproductive system related antigen-like polypeptides on a solid support and bringing a solution of the plurality of molecules in contact with the immobilized reproductive system related antigen polypeptides or reproductive system related antigen-like polypeptides. Such a procedure would be akin to an affinity chromatographic process, with the affinity matrix being comprised of the immobilized reproductive system related antigen polypeptides or reproductive system related antigen-like polypeptides. The molecules having a selective affinity for the reproductive system related antigen polypeptides or reproductive system related antigen-like polypeptides can then be purified by affinity selection. The nature of the solid support, process for attachment of the reproductive system related antigen polypeptides or reproductive system related antigen-like polypeptides to the solid support, solvent, and conditions of the affinity isolation or selection are largely conventional and well known to those of ordinary skill in the art.

[0808] Alternatively, one may also separate a plurality of polypeptides into substantially separate fractions comprising a subset of or individual polypeptides. For instance, one can separate the plurality of polypeptides by gel electrophoresis, column chromatography, or like method known to those of ordinary skill for the separation of polypeptides. The individual polypeptides can also be produced by a transformed host cell in such a way as to be expressed on or about its outer surface (e.g., a recombinant phage). Individual isolates can then be "probed" by the reproductive system related antigen polypeptides or reproductive system related antigen-like polypeptides, optionally in the presence of an inducer should one be required for expression, to

determine if any selective affinity interaction takes place between the reproductive system related antigen polypeptides or reproductive system related antigen-like polypeptides and the individual clone. Prior to contacting the reproductive system related antigen polypeptides or reproductive system related antigen-like polypeptides with each fraction comprising individual polypeptides, the polypeptides could first be transferred to a solid support for additional convenience. Such a solid support may simply be a piece of filter membrane, such as one made of nitrocellulose or nylon. In this manner, positive clones could be identified from a collection of transformed host cells of an expression library, which harbor a DNA construct encoding a polypeptide having a selective affinity for reproductive system related antigen polypeptides or reproductive system related antigen-like polypeptides. Furthermore, the amino acid sequence of the polypeptide having a selective affinity for the reproductive system related antigen polypeptides or reproductive system related antigen-like polypeptides can be determined directly by conventional means or the coding sequence of the DNA encoding the polypeptide can frequently be determined more conveniently. The primary sequence can then be deduced from the corresponding DNA sequence. If the amino acid sequence is to be determined from the polypeptide itself, one may use microsequencing techniques. The sequencing technique may include mass spectroscopy.

[0809] In certain situations, it may be desirable to wash away any unbound reproductive system related antigen polypeptides or reproductive system related antigen-like polypeptides, or alternatively, unbound polypeptides, from a mixture of the reproductive system related antigen polypeptides or reproductive system related antigen-like polypeptides and the plurality of polypeptides prior to attempting to determine or to detect the presence of a selective affinity interaction. Such a wash step may be particularly desirable when the reproductive system related antigen polypeptides or reproductive system related antigen-like polypeptides or the plurality of polypeptides is bound to a solid support.

[0810] The plurality of molecules provided according to this method may be provided by way of diversity libraries, such as random or combinatorial peptide or nonpeptide libraries which can be screened for molecules that specifically bind reproductive system related antigen polypeptides. Many libraries are known in the art

that can be used, e.g., chemically synthesized libraries, recombinant (e.g., phage display libraries), and *in vitro* translation-based libraries. Examples of chemically synthesized libraries are described in Fodor et al., 1991, Science 251:767-773; Houghten et al., 1991, Nature 354:84-86; Lam et al., 1991, Nature 354:82-84; Medynski, 1994, Bio/Technology 12:709-710; Gallop et al., 1994, J. Medicinal Chemistry 37(9):1233-1251; Ohlmeyer et al., 1993, Proc. Natl. Acad. Sci. USA 90:10922-10926; Erb et al., 1994, Proc. Natl. Acad. Sci. USA 91:11422-11426; Houghten et al., 1992, Biotechniques 13:412; Jayawickreme et al., 1994, Proc. Natl. Acad. Sci. USA 91:1614-1618; Salmon et al., 1993, Proc. Natl. Acad. Sci. USA 90:11708-11712; PCT Publication No. WO 93/20242; and Brenner and Lerner, 1992, Proc. Natl. Acad. Sci. USA 89:5381-5383.

[0811] Examples of phage display libraries are described in Scott and Smith, 1990, Science 249:386-390; Devlin et al., 1990, Science, 249:404-406; Christian, R. B., et al., 1992, J. Mol. Biol. 227:711-718; Lenstra, 1992, J. Immunol. Meth. 152:149-157; Kay et al., 1993, Gene 128:59-65; and PCT Publication No. WO 94/18318 dated Aug. 18, 1994.

[0812] *In vitro* translation-based libraries include but are not limited to those described in PCT Publication No. WO 91/05058 dated Apr. 18, 1991; and Mattheakis et al., 1994, Proc. Natl. Acad. Sci. USA 91:9022-9026.

[0813] By way of examples of nonpeptide libraries, a benzodiazepine library (see e.g., Bunin et al., 1994, Proc. Natl. Acad. Sci. USA 91:4708-4712) can be adapted for use. Peptoid libraries (Simon et al., 1992, Proc. Natl. Acad. Sci. USA 89:9367-9371) can also be used. Another example of a library that can be used, in which the amide functionalities in peptides have been permethylated to generate a chemically transformed combinatorial library, is described by Ostresh et al. (1994, Proc. Natl. Acad. Sci. USA 91:11138-11142).

[0814] The variety of non-peptide libraries that are useful in the present invention is great. For example, Ecker and Crooke, 1995, Bio/Technology 13:351-360 list benzodiazepines, hydantoins, piperazinediones, biphenyls, sugar analogs, beta-mercaptoketones, arylacetic acids, acylpiperidines, benzopyrans, cubanes, xanthines, aminimides, and oxazolones as among the chemical species that form the basis of various libraries.

- [0815] Non-peptide libraries can be classified broadly into two types: decorated monomers and oligomers. Decorated monomer libraries employ a relatively simple scaffold structure upon which a variety of functional groups is added. Often the scaffold will be a molecule with a known useful pharmacological activity. For example, the scaffold might be the benzodiazepine structure.
- [0816] Non-peptide oligomer libraries utilize a large number of monomers that are assembled together in ways that create new shapes that depend on the order of the monomers. Among the monomer units that have been used are carbamates, pyrrolinones, and morpholinos. Peptoids, peptide-like oligomers in which the side chain is attached to the alpha amino group rather than the alpha carbon, form the basis of another version of non-peptide oligomer libraries. The first non-peptide oligomer libraries utilized a single type of monomer and thus contained a repeating backbone. Recent libraries have utilized more than one monomer, giving the libraries added flexibility.
- [0817] Screening the libraries can be accomplished by any of a variety of commonly known methods. See, e.g., the following references, which disclose screening of peptide libraries: Parmley and Smith, 1989, *Adv. Exp. Med. Biol.* 251:215-218; Scott and Smith, 1990, *Science* 249:386-390; Fowlkes et al., 1992, *BioTechniques* 13:422-427; Oldenburg et al., 1992, *Proc. Natl. Acad. Sci. USA* 89:5393-5397; Yu et al., 1994, *Cell* 76:933-945; Staudt et al., 1988, *Science* 241:577-580; Bock et al., 1992, *Nature* 355:564-566; Tuerk et al., 1992, *Proc. Natl. Acad. Sci. USA* 89:6988-6992; Ellington et al., 1992, *Nature* 355:850-852; U.S. Pat. No. 5,096,815, U.S. Pat. No. 5,223,409, and U.S. Pat. No. 5,198,346, all to Ladner et al.; Rebar and Pabo, 1993, *Science* 263:671-673; and CT Publication No. WO 94/18318.
- [0818] In a specific embodiment, screening to identify a molecule that binds reproductive system related antigen polypeptides can be carried out by contacting the library members with a reproductive system related antigen polypeptides or reproductive system related antigen-like polypeptides immobilized on a solid phase and harvesting those library members that bind to the reproductive system related antigen polypeptides or reproductive system related antigen-like polypeptides. Examples of such screening methods, termed "panning" techniques are described by way of example in Parmley and Smith, 1988, *Gene* 73:305-318; Fowlkes et al., 1992,

BioTechniques 13:422-427; International Publication No. WO 94/18318; and in references cited herein.

[0819] In another embodiment, the two-hybrid system for selecting interacting proteins in yeast (Fields and Song, 1989, Nature 340:245-246; Chien et al., 1991, Proc. Natl. Acad. Sci. USA 88:9578-9582) can be used to identify molecules that specifically bind to reproductive system related antigen polypeptides or reproductive system related antigen-like polypeptides.

[0820] Where the reproductive system related antigen binding molecule is a polypeptide, the polypeptide can be conveniently selected from any peptide library, including random peptide libraries, combinatorial peptide libraries, or biased peptide libraries. The term "biased" is used herein to mean that the method of generating the library is manipulated so as to restrict one or more parameters that govern the diversity of the resulting collection of molecules, in this case peptides.

[0821] Thus, a truly random peptide library would generate a collection of peptides in which the probability of finding a particular amino acid at a given position of the peptide is the same for all 20 amino acids. A bias can be introduced into the library, however, by specifying, for example, that a lysine occur every fifth amino acid or that positions 4, 8, and 9 of a decapeptide library be fixed to include only arginine. Clearly, many types of biases can be contemplated, and the present invention is not restricted to any particular bias. Furthermore, the present invention contemplates specific types of peptide libraries, such as phage displayed peptide libraries and those that utilize a DNA construct comprising a lambda phage vector with a DNA insert.

[0822] As mentioned above, in the case of a reproductive system related antigen binding molecule that is a polypeptide, the polypeptide may have about 6 to less than about 60 amino acid residues, preferably about 6 to about 10 amino acid residues, and most preferably, about 6 to about 22 amino acids. In another embodiment, a reproductive system related antigen binding polypeptide has in the range of 15-100 amino acids, or 20-50 amino acids.

[0823] The selected reproductive system related antigen binding polypeptide can be obtained by chemical synthesis or recombinant expression.

Other Activities

- [0824] A polypeptide, polynucleotide, agonist, or antagonist of the present invention, as a result of the ability to stimulate vascular endothelial cell growth, may be employed in treatment for stimulating re-vascularization of ischemic tissues due to various disease conditions such as thrombosis, arteriosclerosis, and other cardiovascular conditions. The polypeptide, polynucleotide, agonist, or antagonist of the present invention may also be employed to stimulate angiogenesis and limb regeneration, as discussed above.
- [0825] A polypeptide, polynucleotide, agonist, or antagonist of the present invention may also be employed for treating wounds due to injuries, burns, post-operative tissue repair, and ulcers since they are mitogenic to various cells of different origins, such as fibroblast cells and skeletal muscle cells, and therefore, facilitate the repair or replacement of damaged or diseased tissue.
- [0826] A polypeptide, polynucleotide, agonist, or antagonist of the present invention may also be employed to stimulate neuronal growth and to treat and prevent neuronal damage which occurs in certain neuronal disorders or neuro-degenerative conditions such as Alzheimer's disease, Parkinson's disease, and AIDS-related complex. A polypeptide, polynucleotide, agonist, or antagonist of the present invention may have the ability to stimulate chondrocyte growth, therefore, they may be employed to enhance bone and periodontal regeneration and aid in tissue transplants or bone grafts.
- [0827] A polypeptide, polynucleotide, agonist, or antagonist of the present invention may be also be employed to prevent skin aging due to sunburn by stimulating keratinocyte growth.
- [0828] A polypeptide, polynucleotide, agonist, or antagonist of the present invention may also be employed for preventing hair loss, since FGF family members activate hair-forming cells and promotes melanocyte growth. Along the same lines, a polypeptide, polynucleotide, agonist, or antagonist of the present invention may be employed to stimulate growth and differentiation of hematopoietic cells and bone marrow cells when used in combination with other cytokines.
- [0829] A polypeptide, polynucleotide, agonist, or antagonist of the present invention may also be employed to maintain organs before transplantation or for

supporting cell culture of primary tissues. A polypeptide, polynucleotide, agonist, or antagonist of the present invention may also be employed for inducing tissue of mesodermal origin to differentiate in early embryos.

[0830] A polypeptide, polynucleotide, agonist, or antagonist of the present invention may also increase or decrease the differentiation or proliferation of embryonic stem cells, besides, as discussed above, hematopoietic lineage.

[0831] A polypeptide, polynucleotide, agonist, or antagonist of the present invention may also be used to modulate mammalian characteristics, such as body height, weight, hair color, eye color, skin, percentage of adipose tissue, pigmentation, size, and shape (e.g., cosmetic surgery). Similarly, a polypeptide, polynucleotide, agonist, or antagonist of the present invention may be used to modulate mammalian metabolism affecting catabolism, anabolism, processing, utilization, and storage of energy.

[0832] A polypeptide, polynucleotide, agonist, or antagonist of the present invention may be used to change a mammal's mental state or physical state by influencing biorhythms, circadian rhythms, depression (including depressive disorders), tendency for violence, tolerance for pain, reproductive capabilities (preferably by Activin or Inhibin-like activity), hormonal or endocrine levels, appetite, libido, memory, stress, or other cognitive qualities.

[0833] A polypeptide, polynucleotide, agonist, or antagonist of the present invention may also be used as a food additive or preservative, such as to increase or decrease storage capabilities, fat content, lipid, protein, carbohydrate, vitamins, minerals, cofactors or other nutritional components.

[0834] The above-recited applications have uses in a wide variety of hosts. Such hosts include, but are not limited to, human, murine, rabbit, goat, guinea pig, camel, horse, mouse, rat, hamster, pig, micro-pig, chicken, goat, cow, sheep, dog, cat, non-human primate, and human. In specific embodiments, the host is a mouse, rabbit, goat, guinea pig, chicken, rat, hamster, pig, sheep, dog or cat. In preferred embodiments, the host is a mammal. In most preferred embodiments, the host is a human.

Other Preferred Embodiments

[0835] Other preferred embodiments of the claimed invention include an isolated nucleic acid molecule comprising a nucleotide sequence which is at least 95% identical to a sequence of at least about 50 contiguous nucleotides in the nucleotide sequence of SEQ ID NO:X or the complementary strand thereto, the nucleotide sequence as defined in column 4 of Table 1A or columns 8 and 9 of Table 2 or the complementary strand thereto, and/or cDNA contained in Clone ID NO:Z.

[0836] Also preferred is a nucleic acid molecule wherein said sequence of contiguous nucleotides is included in the nucleotide sequence of the portion of SEQ ID NO:X as defined in column 4, "ORF (From-To)", in Table 1A.

[0837] Also preferred is a nucleic acid molecule wherein said sequence of contiguous nucleotides is included in the nucleotide sequence of the portion of SEQ ID NO:X as defined in columns 8 and 9, "NT From" and "NT To" respectively, in Table 2.

[0838] Also preferred is an isolated nucleic acid molecule comprising a nucleotide sequence which is at least 95% identical to a sequence of at least about 150 contiguous nucleotides in the nucleotide sequence of SEQ ID NO:X or the complementary strand thereto, the nucleotide sequence as defined in column 4 of Table 1A or columns 8 and 9 of Table 2 or the complementary strand thereto, and/or cDNA contained in Clone ID NO:Z.

[0839] Further preferred is an isolated nucleic acid molecule comprising a nucleotide sequence which is at least 95% identical to a sequence of at least about 500 contiguous nucleotides in the nucleotide sequence of SEQ ID NO:X or the complementary strand thereto, the nucleotide sequence as defined in column 4 of Table 1A or columns 8 and 9 of Table 2 or the complementary strand thereto, and/or cDNA contained in Clone ID NO:Z.

[0840] A further preferred embodiment is a nucleic acid molecule comprising a nucleotide sequence which is at least 95% identical to the nucleotide sequence of the portion of SEQ ID NO:X defined in column 4, "ORF (From-To)", in Table 1A.

[0841] A further preferred embodiment is a nucleic acid molecule comprising a nucleotide sequence which is at least 95% identical to the nucleotide sequence of the portion of SEQ ID NO:X defined in columns 8 and 9, "NT From" and "NT To", respectively, in Table 2.

[0842] A further preferred embodiment is an isolated nucleic acid molecule comprising a nucleotide sequence which is at least 95% identical to the complete nucleotide sequence of SEQ ID NO:X or the complementary strand thereto, the nucleotide sequence as defined in column 4 of Table 1A or columns 8 and 9 of Table 2 or the complementary strand thereto, and/or cDNA contained in Clone ID NO:Z.

[0843] Also preferred is an isolated nucleic acid molecule which hybridizes under stringent hybridization conditions to a nucleic acid molecule comprising a nucleotide sequence of SEQ ID NO:X or the complementary strand thereto, the nucleotide sequence as defined in column 4 of Table 1A or columns 8 and 9 of Table 2 or the complementary strand thereto, and/or cDNA contained in Clone ID NO:Z, wherein said nucleic acid molecule which hybridizes does not hybridize under stringent hybridization conditions to a nucleic acid molecule having a nucleotide sequence consisting of only A residues or of only T residues.

[0844] Also preferred is a composition of matter comprising a DNA molecule which comprises the cDNA contained in Clone ID NO:Z.

[0845] Also preferred is an isolated nucleic acid molecule comprising a nucleotide sequence which is at least 95% identical to a sequence of at least 50 contiguous nucleotides of the cDNA sequence contained in Clone ID NO:Z.

[0846] Also preferred is an isolated nucleic acid molecule, wherein said sequence of at least 50 contiguous nucleotides is included in the nucleotide sequence of an open reading frame sequence encoded by cDNA contained in Clone ID NO:Z.

[0847] Also preferred is an isolated nucleic acid molecule comprising a nucleotide sequence which is at least 95% identical to sequence of at least 150 contiguous nucleotides in the nucleotide sequence encoded by cDNA contained in Clone ID NO:Z.

[0848] A further preferred embodiment is an isolated nucleic acid molecule comprising a nucleotide sequence which is at least 95% identical to sequence of at least 500 contiguous nucleotides in the nucleotide sequence encoded by cDNA contained in Clone ID NO:Z.

[0849] A further preferred embodiment is an isolated nucleic acid molecule comprising a nucleotide sequence which is at least 95% identical to the complete nucleotide sequence encoded by cDNA contained in Clone ID NO:Z.

- [0850] A further preferred embodiment is a method for detecting in a biological sample a nucleic acid molecule comprising a nucleotide sequence which is at least 95% identical to a sequence of at least 50 contiguous nucleotides in a sequence selected from the group consisting of: a nucleotide sequence of SEQ ID NO:X or the complementary strand thereto; the nucleotide sequence as defined in column 4 of Table 1A or columns 8 and 9 of Table 2 or the complementary strand thereto; and a nucleotide sequence encoded by cDNA contained in Clone ID NO:Z; which method comprises a step of comparing a nucleotide sequence of at least one nucleic acid molecule in said sample with a sequence selected from said group and determining whether the sequence of said nucleic acid molecule in said sample is at least 95% identical to said selected sequence.
- [0851] Also preferred is the above method wherein said step of comparing sequences comprises determining the extent of nucleic acid hybridization between nucleic acid molecules in said sample and a nucleic acid molecule comprising said sequence selected from said group. Similarly, also preferred is the above method wherein said step of comparing sequences is performed by comparing the nucleotide sequence determined from a nucleic acid molecule in said sample with said sequence selected from said group. The nucleic acid molecules can comprise DNA molecules or RNA molecules.
- [0852] A further preferred embodiment is a method for identifying the species, tissue or cell type of a biological sample which method comprises a step of detecting nucleic acid molecules in said sample, if any, comprising a nucleotide sequence that is at least 95% identical to a sequence of at least 50 contiguous nucleotides in a sequence selected from the group consisting of: a nucleotide sequence of SEQ ID NO:X or the complementary strand thereto; the nucleotide sequence as defined in column 4 of Table 1A or columns 8 and 9 of Table 2 or the complementary strand thereto; and a nucleotide sequence of the cDNA contained in Clone ID NO:Z.
- [0853] The method for identifying the species, tissue or cell type of a biological sample can comprise a step of detecting nucleic acid molecules comprising a nucleotide sequence in a panel of at least two nucleotide sequences, wherein at least one sequence in said panel is at least 95% identical to a sequence of at least 50 contiguous nucleotides in a sequence selected from said group.

[0854] Also preferred is a method for diagnosing in a subject a pathological condition associated with abnormal structure or expression of a nucleotide sequence of SEQ ID NO:X or the complementary strand thereto; the nucleotide sequence as defined in column 4 of Table 1A or columns 8 and 9 of Table 2 or the complementary strand thereto; or the cDNA contained in Clone ID NO:Z which encodes a protein, wherein the method comprises a step of detecting in a biological sample obtained from said subject nucleic acid molecules, if any, comprising a nucleotide sequence that is at least 95% identical to a sequence of at least 50 contiguous nucleotides in a sequence selected from the group consisting of: a nucleotide sequence of SEQ ID NO:X or the complementary strand thereto; the nucleotide sequence as defined in column 4 of Table 1A or columns 8 and 9 of Table 2 or the complementary strand thereto; and a nucleotide sequence of cDNA contained in Clone ID NO:Z.

[0855] The method for diagnosing a pathological condition can comprise a step of detecting nucleic acid molecules comprising a nucleotide sequence in a panel of at least two nucleotide sequences, wherein at least one sequence in said panel is at least 95% identical to a sequence of at least 50 contiguous nucleotides in a sequence selected from said group.

[0856] Also preferred is a composition of matter comprising isolated nucleic acid molecules wherein the nucleotide sequences of said nucleic acid molecules comprise a panel of at least two nucleotide sequences, wherein at least one sequence in said panel is at least 95% identical to a sequence of at least 50 contiguous nucleotides in a sequence selected from the group consisting of: a nucleotide sequence of SEQ ID NO:X or the complementary strand thereto; the nucleotide sequence as defined in column 4 of Table 1A or columns 8 and 9 of Table 2 or the complementary strand thereto; and a nucleotide sequence encoded by cDNA contained in Clone ID NO:Z. The nucleic acid molecules can comprise DNA molecules or RNA molecules.

[0857] Also preferred is a composition of matter comprising isolated nucleic acid molecules wherein the nucleotide sequences of said nucleic acid molecules comprise a DNA microarray or "chip" of at least 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 15, 20, 25, 30, 40, 50, 100, 150, 200, 250, 300, 500, 1000, 2000, 3000, or 4000 nucleotide sequences, wherein at least one sequence in said DNA microarray or "chip" is at least 95% identical to a sequence of at least 50 contiguous nucleotides in a sequence selected

from the group consisting of: a nucleotide sequence of SEQ ID NO:X wherein X is any integer as defined in Table 1A; and a nucleotide sequence encoded by a human cDNA clone identified by a cDNA "Clone ID" in Table 1A.

[0858] Also preferred is an isolated polypeptide comprising an amino acid sequence at least 90% identical to a sequence of at least about 10 contiguous amino acids in the polypeptide sequence of SEQ ID NO:Y; a polypeptide encoded by SEQ ID NO:X or the complementary strand thereto; the polypeptide encoded by the nucleotide sequence as defined in columns 8 and 9 of Table 2; and/or a polypeptide encoded by cDNA contained in Clone ID NO:Z.

[0859] Also preferred is an isolated polypeptide comprising an amino acid sequence at least 95% identical to a sequence of at least about 30 contiguous amino acids in the amino acid sequence of SEQ ID NO:Y; a polypeptide encoded by SEQ ID NO:X or the complementary strand thereto; the polypeptide encoded by the nucleotide sequence as defined in columns 8 and 9 of Table 2; and/or a polypeptide encoded by cDNA contained in Clone ID NO:Z.

[0860] Further preferred is an isolated polypeptide comprising an amino acid sequence at least 95% identical to a sequence of at least about 100 contiguous amino acids in the amino acid sequence of SEQ ID NO:Y; a polypeptide encoded by SEQ ID NO:X or the complementary strand thereto; the polypeptide encoded by the nucleotide sequence as defined in columns 8 and 9 of Table 2; and/or a polypeptide encoded by cDNA contained in Clone ID NO:Z.

[0861] Further preferred is an isolated polypeptide comprising an amino acid sequence at least 95% identical to the complete amino acid sequence of SEQ ID NO:Y; a polypeptide encoded by SEQ ID NO:X or the complementary strand thereto; the polypeptide encoded by the nucleotide sequence as defined in columns 8 and 9 of Table 2; and/or a polypeptide encoded by cDNA contained in Clone ID NO:Z.

[0862] Further preferred is an isolated polypeptide comprising an amino acid sequence at least 90% identical to a sequence of at least about 10 contiguous amino acids in the complete amino acid sequence of a polypeptide encoded by contained in Clone ID NO:Z

[0863] Also preferred is a polypeptide wherein said sequence of contiguous amino acids is included in the amino acid sequence of a portion of said polypeptide encoded

by cDNA contained in Clone ID NO:Z; a polypeptide encoded by SEQ ID NO:X or the complementary strand thereto; the polypeptide encoded by the nucleotide sequence as defined in columns 8 and 9 of Table 2; and/or the polypeptide sequence of SEQ ID NO:Y.

[0864] Also preferred is an isolated polypeptide comprising an amino acid sequence at least 95% identical to a sequence of at least about 30 contiguous amino acids in the amino acid sequence of a polypeptide encoded by the cDNA contained in Clone ID NO:Z.

[0865] Also preferred is an isolated polypeptide comprising an amino acid sequence at least 95% identical to a sequence of at least about 100 contiguous amino acids in the amino acid sequence of a polypeptide encoded by cDNA contained in Clone ID NO:Z.

[0866] Also preferred is an isolated polypeptide comprising an amino acid sequence at least 95% identical to the amino acid sequence of a polypeptide encoded by the cDNA contained in Clone ID NO:Z.

[0867] Further preferred is an isolated antibody, which binds specifically to a polypeptide comprising an amino acid sequence that is at least 90% identical to a sequence of at least 10 contiguous amino acids in a sequence selected from the group consisting of: a polypeptide sequence of SEQ ID NO:Y; a polypeptide encoded by SEQ ID NO:X or the complementary strand thereto; the polypeptide encoded by the nucleotide sequence as defined in columns 8 and 9 of Table 2; and a polypeptide encoded by the cDNA contained in Clone ID NO:Z.

[0868] Further preferred is a method for detecting in a biological sample a polypeptide comprising an amino acid sequence which is at least 90% identical to a sequence of at least 10 contiguous amino acids in a sequence selected from the group consisting of: a polypeptide sequence of SEQ ID NO:Y; a polypeptide encoded by SEQ ID NO:X or the complementary strand thereto; the polypeptide encoded by the nucleotide sequence as defined in columns 8 and 9 of Table 2; and a polypeptide encoded by the cDNA contained in Clone ID NO:Z; which method comprises a step of comparing an amino acid sequence of at least one polypeptide molecule in said sample with a sequence selected from said group and determining whether the sequence of

said polypeptide molecule in said sample is at least 90% identical to said sequence of at least 10 contiguous amino acids.

[0869] Also preferred is the above method wherein said step of comparing an amino acid sequence of at least one polypeptide molecule in said sample with a sequence selected from said group comprises determining the extent of specific binding of polypeptides in said sample to an antibody which binds specifically to a polypeptide comprising an amino acid sequence that is at least 90% identical to a sequence of at least 10 contiguous amino acids in a sequence selected from the group consisting of: a polypeptide sequence of SEQ ID NO:Y; a polypeptide encoded by SEQ ID NO:X or the complementary strand thereto; the polypeptide encoded by the nucleotide sequence as defined in columns 8 and 9 of Table 2; and a polypeptide encoded by the cDNA contained in Clone ID NO:Z.

[0870] Also preferred is the above method wherein said step of comparing sequences is performed by comparing the amino acid sequence determined from a polypeptide molecule in said sample with said sequence selected from said group.

[0871] Also preferred is a method for identifying the species, tissue or cell type of a biological sample which method comprises a step of detecting polypeptide molecules in said sample, if any, comprising an amino acid sequence that is at least 90% identical to a sequence of at least 10 contiguous amino acids in a sequence selected from the group consisting of: polypeptide sequence of SEQ ID NO:Y; a polypeptide encoded by SEQ ID NO:X or the complementary strand thereto; the polypeptide encoded by the nucleotide sequence as defined in columns 8 and 9 of Table 2; and a polypeptide encoded by the cDNA contained in Clone ID NO:Z.

[0872] Also preferred is the above method for identifying the species, tissue or cell type of a biological sample, which method comprises a step of detecting polypeptide molecules comprising an amino acid sequence in a panel of at least two amino acid sequences, wherein at least one sequence in said panel is at least 90% identical to a sequence of at least 10 contiguous amino acids in a sequence selected from the above group.

[0873] Also preferred is a method for diagnosing in a subject a pathological condition associated with abnormal structure or expression of a nucleic acid sequence identified in Table 1A or Table 2 encoding a polypeptide, which method comprises a

step of detecting in a biological sample obtained from said subject polypeptide molecules comprising an amino acid sequence in a panel of at least two amino acid sequences, wherein at least one sequence in said panel is at least 90% identical to a sequence of at least 10 contiguous amino acids in a sequence selected from the group consisting of: polypeptide sequence of SEQ ID NO:Y; a polypeptide encoded by SEQ ID NO:X or the complementary strand thereto; the polypeptide encoded by the nucleotide sequence as defined in columns 8 and 9 of Table 2; and a polypeptide encoded by the cDNA contained in Clone ID NO:Z.

[0874] In any of these methods, the step of detecting said polypeptide molecules includes using an antibody.

[0875] Also preferred is an isolated nucleic acid molecule comprising a nucleotide sequence which is at least 95% identical to a nucleotide sequence encoding a polypeptide wherein said polypeptide comprises an amino acid sequence that is at least 90% identical to a sequence of at least 10 contiguous amino acids in a sequence selected from the group consisting of: polypeptide sequence of SEQ ID NO:Y; a polypeptide encoded by SEQ ID NO:X or the complementary strand thereto; the polypeptide encoded by the nucleotide sequence as defined in columns 8 and 9 of Table 2; and a polypeptide encoded by the cDNA contained in Clone ID NO:Z.

[0876] Also preferred is an isolated nucleic acid molecule, wherein said nucleotide sequence encoding a polypeptide has been optimized for expression of said polypeptide in a prokaryotic host.

[0877] Also preferred is a polypeptide molecule, wherein said polypeptide comprises an amino acid sequence selected from the group consisting of: polypeptide sequence of SEQ ID NO:Y; a polypeptide encoded by SEQ ID NO:X or the complementary strand thereto; the polypeptide encoded by the nucleotide sequence as defined in columns 8 and 9 of Table 2; and a polypeptide encoded by the cDNA contained in Clone ID NO:Z.

[0878] Further preferred is a method of making a recombinant vector comprising inserting any of the above isolated nucleic acid molecule into a vector. Also preferred is the recombinant vector produced by this method. Also preferred is a method of making a recombinant host cell comprising introducing the vector into a host cell, as well as the recombinant host cell produced by this method.

- [0879] Also preferred is a method of making an isolated polypeptide comprising culturing this recombinant host cell under conditions such that said polypeptide is expressed and recovering said polypeptide. Also preferred is this method of making an isolated polypeptide, wherein said recombinant host cell is a eukaryotic cell and said polypeptide is a human protein comprising an amino acid sequence selected from the group consisting of: polypeptide sequence of SEQ ID NO:Y; a polypeptide encoded by SEQ ID NO:X or the complementary strand thereto; the polypeptide encoded by the nucleotide sequence as defined in columns 8 and 9 of Table 2; and a polypeptide encoded by the cDNA contained in Clone ID NO:Z. The isolated polypeptide produced by this method is also preferred.
- [0880] Also preferred is a method of treatment of an individual in need of an increased level of a protein activity, which method comprises administering to such an individual a Therapeutic comprising an amount of an isolated polypeptide, polynucleotide, immunogenic fragment or analogue thereof, binding agent, antibody, or antigen binding fragment of the claimed invention effective to increase the level of said protein activity in said individual.
- [0881] Also preferred is a method of treatment of an individual in need of a decreased level of a protein activity, which method comprised administering to such an individual a Therapeutic comprising an amount of an isolated polypeptide, polynucleotide, immunogenic fragment or analogue thereof, binding agent, antibody, or antigen binding fragment of the claimed invention effective to decrease the level of said protein activity in said individual.
- [0882] Also preferred is a method of treatment of an individual in need of a specific delivery of toxic compositions to diseased cells (e.g., tumors, leukemias or lymphomas), which method comprises administering to such an individual a Therapeutic comprising an amount of an isolated polypeptide of the invention, including, but not limited to a binding agent, or antibody of the claimed invention that are associated with toxin or cytotoxic prodrugs.
- [0883] Having generally described the invention, the same will be more readily understood by reference to the following examples, which are provided by way of illustration and are not intended as limiting.

TABLE 6

ATCC Deposits	Deposit Date	ATCC Designation Number
LP01, LP02, LP03, LP04, LP05, LP06, LP07, LP08, LP09, LP10, LP11,	May-20-97	209059, 209060, 209061, 209062, 209063, 209064, 209065, 209066, 209067, 209068, 209069
LP12	Jan-12-98	209579
LP13	Jan-12-98	209578
LP14	Jul-16-98	203067
LP15	Jul-16-98	203068
LP16	Feb-1-99	203609
LP17	Feb-1-99	203610
LP20	Nov-17-98	203485
LP21	Jun-18-99	PTA-252
LP22	Jun-18-99	PTA-253
LP23	Dec-22-99	PTA-1081

Examples

Example 1: Isolation of a Selected cDNA Clone From the Deposited Sample

[0884] Each Clone ID NO:Z is contained in a plasmid. Table 7 identifies the vectors used to construct the cDNA library from which each clone was isolated. In many cases, the vector used to construct the library is a phage vector from which a plasmid has been excised. The following correlates the related plasmid for each phage vector used in constructing the cDNA library. For example, where a particular clone is identified in Table 7 as being isolated in the vector "Lambda Zap," the corresponding deposited clone is in "pBluescript."

<u>Vector Used to Construct Library</u>	<u>Corresponding Deposited Plasmid</u>
Lambda Zap	pBluescript (pBS)
Uni-Zap XR	pBluescript (pBS)
Zap Express	pBK
lafmid BA	plafmid BA
pSport1	pSport1
pCMVSPORT 2.0	pCMVSPORT 2.0
pCMVSPORT 3.0	pCMVSPORT 3.0
pCR [®] 2.1	pCR [®] 2.1

[0885] Vectors Lambda Zap (U.S. Patent Nos. 5,128,256 and 5,286,636), Uni-Zap XR (U.S. Patent Nos. 5,128, 256 and 5,286,636), Zap Express (U.S. Patent Nos. 5,128,256 and 5,286,636), pBluescript (pBS) (Short, J. M. et al., Nucleic Acids Res. 16:7583-7600 (1988); Alting-Mees, M. A. and Short, J. M., Nucleic Acids Res. 17:9494 (1989)) and pBK (Alting-Mees, M. A. et al., Strategies 5:58-61 (1992)) are commercially available from Stratagene Cloning Systems, Inc., 11011 N. Torrey Pines Road, La Jolla, CA, 92037. pBS contains an ampicillin resistance gene and pBK contains a neomycin resistance gene. Both can be transformed into E. coli strain XL-1 Blue, also available from Stratagene. pBS comes in 4 forms SK+, SK-, KS+ and KS. The S and K refers to the orientation of the polylinker to the T7 and T3 primer

sequences which flank the polylinker region ("S" is for SacI and "K" is for KpnI which are the first sites on each respective end of the linker). "+" or "-" refer to the orientation of the fl origin of replication ("ori"), such that in one orientation, single stranded rescue initiated from the fl ori generates sense strand DNA and in the other, antisense.

[0886] Vectors pSport1, pCMVSPORT 2.0 and pCMVSPORT 3.0, were obtained from Life Technologies, Inc., P. O. Box 6009, Gaithersburg, MD 20897. All Sport vectors contain an ampicillin resistance gene and may be transformed into E. coli strain DH10B, also available from Life Technologies. (See, for instance, Gruber, C. E., et al., Focus 15:59 (1993).) Vector lacmid BA (Bento Soares, Columbia University, NY) contains an ampicillin resistance gene and can be transformed into E. coli strain XL-1 Blue. Vector pCR[®]2.1, which is available from Invitrogen, 1600 Faraday Avenue, Carlsbad, CA 92008, contains an ampicillin resistance gene and may be transformed into E. coli strain DH10B, available from Life Technologies. (See, for instance, Clark, J. M., Nuc. Acids Res. 16:9677-9686 (1988) and Mead, D. et al., Bio/Technology 9: (1991).) Preferably, a polynucleotide of the present invention does not comprise the vector sequences identified for the particular clone in Table 7, as well as the corresponding plasmid vector sequences designated above.

[0887] The deposited material in the sample assigned the ATCC Deposit Number cited by reference to Tables 1A, 2, 6 and 7 for any given cDNA clone also may contain one or more additional plasmids, each comprising a cDNA clone different from that given clone. Thus, deposits sharing the same ATCC Deposit Number contain at least a plasmid for each Clone ID NO:Z.

TABLE 7

Libraries owned by Catalog	Catalog Description	Vector	ATCC Deposit
HUKA HUKB HUKC HUKD HUKE HUKF HUKG	Human Uterine Cancer	Lambda ZAP II	LP01
HCNA HCNB	Human Colon	Lambda Zap II	LP01
HFFA	Human Fetal Brain, random primed	Lambda Zap II	LP01
HTWA	Resting T-Cell	Lambda ZAP II	LP01

Libraries owned by Catalog	Catalog Description	Vector	ATCC Deposit
HBQA	Early Stage Human Brain, random primed	Lambda ZAP II	LP01
HLMB HLMF HLMG HLMH HLMJ HLMK HLMM HLMN	breast lymph node CDNA library	Lambda ZAP II	LP01
HCQA HCQB	human colon cancer	Lambda ZAP II	LP01
HMEA HMEC HMEF HMEG HMEI HMEJ HMEK HMEK	Human Microvascular Endothelial Cells, fract. A	Lambda ZAP II	LP01
HUSA HUSC	Human Umbilical Vein Endothelial Cells, fract. A	Lambda ZAP II	LP01
HLQA HLQB	Hepatocellular Tumor	Lambda ZAP II	LP01
HHGA HHGB HHGC HHGD	Hemangiopericytoma	Lambda ZAP II	LP01
HSDM	Human Striatum Depression, re-rescue	Lambda ZAP II	LP01
HUSH	H Umbilical Vein Endothelial Cells, frac A, re-excision	Lambda ZAP II	LP01
HSGS	Salivary gland, subtracted	Lambda ZAP II	LP01
HFXA HFXB HFXC HFXD HFXE HFXF HFXG HFXH	Brain frontal cortex	Lambda ZAP II	LP01
HPQA HPQB HPQC	PERM TF274	Lambda ZAP II	LP01
HFXJ HFXK	Brain Frontal Cortex, re-excision	Lambda ZAP II	LP01
HCWA HCWB HCWC HCWD HCWE HCWF HCWG HCWH HCWI HCWJ HCWK	CD34 positive cells (Cord Blood)	ZAP Express	LP02
HCUA HCUB HCUC	CD34 depleted Buffy Coat (Cord Blood)	ZAP Express	LP02
HRSM	A-14 cell line	ZAP Express	LP02
HRSA	A1-CELL LINE	ZAP Express	LP02
HCUD HCUE HCUF HCUG HCUH HCUJ	CD34 depleted Buffy Coat (Cord Blood), re-excision	ZAP Express	LP02
HBXE HBXF HBXG	H. Whole Brain #2, re-excision	ZAP Express	LP02
HRLM	L8 cell line	ZAP Express	LP02
HBXA HBXB HBXC HBXD	Human Whole Brain #2 - Oligo dT > 1.5Kb	ZAP Express	LP02
HUDA HUDB HUDC	Testes	ZAP Express	LP02
HHTM HHTN HHTO	H. hypothalamus, frac A; re-excision	ZAP Express	LP02
HHTL	H. hypothalamus, frac A	ZAP Express	LP02
HASA HASD	Human Adult Spleen	Uni-ZAP XR	LP03
HFKC HFKD HFKE HFKF HFKG	Human Fetal Kidney	Uni-ZAP XR	LP03

Libraries owned by Catalog	Catalog Description	Vector	ATCC Deposit
HE8A HE8B HE8C HE8D HE8E HE8F HE8M HE8N	Human 8 Week Whole Embryo	Uni-ZAP XR	LP03
HGBA HGBD HGBE HGBF HGBG HGBH HGBI	Human Gall Bladder	Uni-ZAP XR	LP03
HLHA HLHB HLHC HLHD HLHE HLHF HLHG HLHH HLHQ	Human Fetal Lung III	Uni-ZAP XR	LP03
HPMA HPMB HPMC HPMD HPME HPMF HPMG HPMH	Human Placenta	Uni-ZAP XR	LP03
HPRA HPRB HPRC HPRD	Human Prostate	Uni-ZAP XR	LP03
HSIA HSIC HSID HSIE	Human Adult Small Intestine	Uni-ZAP XR	LP03
HTEA HTEB HTEC HTED HTEE HTEF HTEG HTEH HTEI HTEJ HTEK	Human Testes	Uni-ZAP XR	LP03
HTPA HTPB HTPC HTPD HTPF	Human Pancreas Tumor	Uni-ZAP XR	LP03
HTTA HTTB HTTC HTTD HTTE HTTF	Human Testes Tumor	Uni-ZAP XR	LP03
HAPA HAPB HAPC HAPM	Human Adult Pulmonary	Uni-ZAP XR	LP03
HETA HETB HETC HETD HETE HETF HETG HETH HETI	Human Endometrial Tumor	Uni-ZAP XR	LP03
HHFB HHFC HHFD HHFE HHFF HHFG HHFH HHFI	Human Fetal Heart	Uni-ZAP XR	LP03
HHPB HHPD HHPF HHPG HHPH	Human Hippocampus	Uni-ZAP XR	LP03
HCE1 HCE2 HCE3 HCE4 HCE5 HCEB HCEC HCED HCEE HCEF HCEG	Human Cerebellum	Uni-ZAP XR	LP03
HUVB HUV C HUV D HUV E	Human Umbilical Vein, Endo. remake	Uni-ZAP XR	LP03
HSTA HSTB HSTC HSTD	Human Skin Tumor	Uni-ZAP XR	LP03
HTAA HTAB HTAC HTAD HTAE	Human Activated T-Cells	Uni-ZAP XR	LP03
HFEA HFEB HFEC	Human Fetal Epithelium (Skin)	Uni-ZAP XR	LP03
HJPA HJPB HJPC HJPD	HUMAN JURKAT MEMBRANE BOUND POLYSOMES	Uni-ZAP XR	LP03
HESA	Human epithelioid sarcoma	Uni-Zap XR	LP03
HLTA HLTB HLTC HLTD HLTE HLTF	Human T-Cell Lymphoma	Uni-ZAP XR	LP03
HFTA HFTB HFTC HFTD	Human Fetal Dura Mater	Uni-ZAP XR	LP03
HRDA HRDB HRDC HRDD	Human Rhabdomyosarcoma	Uni-ZAP XR	LP03

Libraries owned by Catalog	Catalog Description	Vector	ATCC Deposit
HRDE HRDF			
HCAA HCAB HCAC	Cem cells cyclohexamide treated	Uni-ZAP XR	LP03
HRGA HRGB HRGC HRGD	Raji Cells, cyclohexamide treated	Uni-ZAP XR	LP03
HSUA HSUB HSUC HSUM	Supt Cells, cyclohexamide treated	Uni-ZAP XR	LP03
HT4A HT4C HT4D	Activated T-Cells, 12 hrs.	Uni-ZAP XR	LP03
HE9A HE9B HE9C HE9D HE9E HE9F HE9G HE9H HE9M HE9N	Nine Week Old Early Stage Human	Uni-ZAP XR	LP03
HATA HATB HATC HATD HATE	Human Adrenal Gland Tumor	Uni-ZAP XR	LP03
HT5A	Activated T-Cells, 24 hrs.	Uni-ZAP XR	LP03
HFGA HFGM	Human Fetal Brain	Uni-ZAP XR	LP03
HNEA HNEB HNEC HNED HNEE	Human Neutrophil	Uni-ZAP XR	LP03
HBGB HBGD	Human Primary Breast Cancer	Uni-ZAP XR	LP03
HBNA HBNB	Human Normal Breast	Uni-ZAP XR	LP03
HCAS	Cem Cells, cyclohexamide treated, subtra	Uni-ZAP XR	LP03
HHPS	Human Hippocampus, subtracted	pBS	LP03
HKCS HKCU	Human Colon Cancer, subtracted	pBS	LP03
HRGS	Raji cells, cyclohexamide treated, subtracted	pBS	LP03
HSUT	Supt cells, cyclohexamide treated, differentially expressed	pBS	LP03
HT4S	Activated T-Cells, 12 hrs, subtracted	Uni-ZAP XR	LP03
HCD A HCDB HCDC HCDD HCDE	Human Chondrosarcoma	Uni-ZAP XR	LP03
HOAA HOAB HOAC	Human Osteosarcoma	Uni-ZAP XR	LP03
HTLA HTLB HTLC HTLD HTLE HTLF	Human adult testis, large inserts	Uni-ZAP XR	LP03
HLMA HLMC HLMD	Breast Lymph node cDNA library	Uni-ZAP XR	LP03
H6EA H6EB H6EC	HL-60, PMA 4H	Uni-ZAP XR	LP03
HTXA HTXB HTXC HTXD HTXE HTXF HTXG HTXH	Activated T-Cell (12hs)/Thiouridine labelledEco	Uni-ZAP XR	LP03
HNFA HNFB HNFC HNFD HNFE HNFF HNFG HNFH HNFJ	Human Neutrophil, Activated	Uni-ZAP XR	LP03
HTOB HTOC	HUMAN TONSILS, FRACTION 2	Uni-ZAP XR	LP03
HMGB	Human OB MG63 control fraction I	Uni-ZAP XR	LP03
HOPB	Human OB HOS control fraction I	Uni-ZAP XR	LP03
HORB	Human OB HOS treated (10 nM E2)	Uni-ZAP XR	LP03

Libraries owned by Catalog	Catalog Description	Vector	ATCC Deposit
	fraction I		
HSVA HSVB HSVC	Human Chronic Synovitis	Uni-ZAP XR	LP03
HROA	HUMAN STOMACH	Uni-ZAP XR	LP03
HBJA HBJB HBJC HBJD HBJE HBJF HBJG HBJH HBJI HBJJ HBJK	HUMAN B CELL LYMPHOMA	Uni-ZAP XR	LP03
HCRA HCRB HCRC	human corpus colosum	Uni-ZAP XR	LP03
HODA HODB HODC HODD	human ovarian cancer	Uni-ZAP XR	LP03
HDSA	Dermatofibrosarcoma Protuberance	Uni-ZAP XR	LP03
HMWA HMWB HMWC HMWD HMWE HMWF HMWG HMWH HMWI HMWJ	Bone Marrow Cell Line (RS4;11)	Uni-ZAP XR	LP03
HSOA	stomach cancer (human)	Uni-ZAP XR	LP03
HERA	SKIN	Uni-ZAP XR	LP03
HMDA	Brain-medulloblastoma	Uni-ZAP XR	LP03
HGLA HGLB HGLD	Glioblastoma	Uni-ZAP XR	LP03
HEAA	H. Atrophic Endometrium	Uni-ZAP XR	LP03
HBCA HBCB	H. Lymph node breast Cancer	Uni-ZAP XR	LP03
HPWT	Human Prostate BPH, re-excision	Uni-ZAP XR	LP03
HFVG HFVH HFVI	Fetal Liver, subtraction II	pBS	LP03
HNFI	Human Neutrophils, Activated, re-excision	pBS	LP03
HBMB HBMC HBMD	Human Bone Marrow, re-excision	pBS	LP03
HKML HKMM HKMN	H. Kidney Medulla, re-excision	pBS	LP03
HKIX HKIY	H. Kidney Cortex, subtracted	pBS	LP03
HADT	H. Amygdala Depression, subtracted	pBS	LP03
H6AS	HL-60, untreated, subtracted	Uni-ZAP XR	LP03
H6ES	HL-60, PMA 4H, subtracted	Uni-ZAP XR	LP03
H6BS	HL-60, RA 4h, Subtracted	Uni-ZAP XR	LP03
H6CS	HL-60, PMA 1d, subtracted	Uni-ZAP XR	LP03
HTXJ HTXK	Activated T-cell(12h)/Thiouridine-re-excision	Uni-ZAP XR	LP03
HMSA HMSB HMSC HMSD HMSE HMSF HMSG HMSH HMSI HMSJ HMSK	Monocyte activated	Uni-ZAP XR	LP03
HAGA HAGB HAGC HAGD HAGE HAGF	Human Amygdala	Uni-ZAP XR	LP03
HSRA HSRB HSRE	STROMAL -OSTEOCLASTOMA	Uni-ZAP XR	LP03
HSRD HSRF HSRG HSRH	Human Osteoclastoma Stromal Cells -	Uni-ZAP XR	LP03

Libraries owned by Catalog	Catalog Description	Vector	ATCC Deposit
	unamplified		
HSQA HSQB HSQC HSQD HSQE HSQF HSQG	Stromal cell TF274	Uni-ZAP XR	LP03
HSKA HSKB HSKC HSKD HSKE HSKF HSKZ	Smooth muscle, serum treated	Uni-ZAP XR	LP03
HSLA HSLB HSLC HSLD HSLE HSLF HSLG	Smooth muscle, control	Uni-ZAP XR	LP03
HSDA HSDD HSDE HSDF HSDG HSDH	Spinal cord	Uni-ZAP XR	LP03
HPWS	Prostate-BPH subtracted II	pBS	LP03
HSKW HSKX HSKY	Smooth Muscle-HASTE normalized	pBS	LP03
HFPB HFPC HFPD	H. Frontal cortex, epileptic; re-excision	Uni-ZAP XR	LP03
HSDI HSDJ HSDK	Spinal Cord, re-excision	Uni-ZAP XR	LP03
HSKN HSKO	Smooth Muscle Serum Treated, Norm	pBS	LP03
HSKG HSKH HSKI	Smooth muscle, serum induced, re-exc	pBS	LP03
HFCA HFCB HFCC HFCD HFCE HFCF	Human Fetal Brain	Uni-ZAP XR	LP04
HPTA HPTB HPTD	Human Pituitary	Uni-ZAP XR	LP04
HTHB HTHC HTHD	Human Thymus	Uni-ZAP XR	LP04
HE6B HE6C HE6D HE6E HE6F HE6G HE6S	Human Whole Six Week Old Embryo	Uni-ZAP XR	LP04
HSSA HSSB HSSC HSSD HSSE HSSF HSSG HSSH HSSI HSSJ HSSK	Human Synovial Sarcoma	Uni-ZAP XR	LP04
HE7T	7 Week Old Early Stage Human, subtracted	Uni-ZAP XR	LP04
HEPA HEPB HEPC	Human Epididymus	Uni-ZAP XR	LP04
HSNA HSNB HSNC HSNM HSNN	Human Synovium	Uni-ZAP XR	LP04
HPFB HPFC HPFD HPFE	Human Prostate Cancer, Stage C fraction	Uni-ZAP XR	LP04
HE2A HE2D HE2E HE2H HE2I HE2M HE2N HE2O	12 Week Old Early Stage Human	Uni-ZAP XR	LP04
HE2B HE2C HE2F HE2G HE2P HE2Q	12 Week Old Early Stage Human, II	Uni-ZAP XR	LP04
HPTS HPTT HPTU	Human Pituitary, subtracted	Uni-ZAP XR	LP04
HAUA HAUB HAUC	Amniotic Cells - TNF induced	Uni-ZAP XR	LP04
HAQA HAQB HAQC HAQD	Amniotic Cells - Primary Culture	Uni-ZAP XR	LP04
HWTA HWTB HWTC	wilm's tumor	Uni-ZAP XR	LP04

Libraries owned by Catalog	Catalog Description	Vector	ATCC Deposit
HBSD	Bone Cancer, re-excision	Uni-ZAP XR	LP04
HSGB	Salivary gland, re-excision	Uni-ZAP XR	LP04
HSJA HSJB HSJC	Smooth muscle-ILb induced	Uni-ZAP XR	LP04
HSXA HSXB HSXC HSXD	Human Substantia Nigra	Uni-ZAP XR	LP04
HSJA HSHB HSHC	Smooth muscle, IL1b induced	Uni-ZAP XR	LP04
HOJA HOJB HOJC HOJD HOUE	Adipocytes	Uni-ZAP XR	LP04
HPWA HPWB HPWC HPWD HPWE	Prostate BPH	Uni-ZAP XR	LP04
HELA HELB HELC HELD HELE HELF HELG HELH	Endothelial cells-control	Uni-ZAP XR	LP04
HEMA HEMB HEMC HEMD HEME HEMF HEMG HEMH	Endothelial-induced	Uni-ZAP XR	LP04
HBIA HBIB HBIC	Human Brain, Striatum	Uni-ZAP XR	LP04
HHSA HHSB HHSC HHSD HHSE	Human Hypothalamus, Schizophrenia	Uni-ZAP XR	LP04
HNGA HNGB HNGC HNGD HNGE HNGF HNGG HNGH HNGI HNGJ	neutrophils control	Uni-ZAP XR	LP04
HNHA HNHB HNHC HNHD HNHE HNHF HNHG HNHH HNHI HNHI	Neutrophils IL-1 and LPS induced	Uni-ZAP XR	LP04
HSDB HSDC	STRIATUM DEPRESSION	Uni-ZAP XR	LP04
HHPT	Hypothalamus	Uni-ZAP XR	LP04
HSAT HSAU HSAV HSAW HSAX HSAY HSAZ	Anergic T-cell	Uni-ZAP XR	LP04
HBMS HBMT HBMU HBMV HBMW HBMX	Bone marrow	Uni-ZAP XR	LP04
HOEA HOEB HOEC HOED HOEE HOEF HOEJ	Osteoblasts	Uni-ZAP XR	LP04
HAJA HAIB HAIC HAID HAIE HAIF	Epithelial-TNF α and INF induced	Uni-ZAP XR	LP04
HTGA HTGB HTGC HTGD	Apoptotic T-cell	Uni-ZAP XR	LP04
HMCA HMCB HMCC HMCD HMCE	Macrophage-oxLDL	Uni-ZAP XR	LP04
HMAA HMAB HMAG HMAD HMAE HMAF HMAG	Macrophage (GM-CSF treated)	Uni-ZAP XR	LP04
HPHA	Normal Prostate	Uni-ZAP XR	LP04
HPJA HPJB HPIC	LNCAP prostate cell line	Uni-ZAP XR	LP04

Libraries owned by Catalog	Catalog Description	Vector	ATCC Deposit
HPJA HPJB HPJC	PC3 Prostate cell line	Uni-ZAP XR	LP04
HOSE HOSF HOSG	Human Osteoclastoma, re-excision	Uni-ZAP XR	LP04
HTGE HTGF	Apoptotic T-cell, re-excision	Uni-ZAP XR	LP04
HMAJ HMAK	H Macrophage (GM-CSF treated), re-excision	Uni-ZAP XR	LP04
HACB HACC HACD	Human Adipose Tissue, re-excision	Uni-ZAP XR	LP04
HFPA	H. Frontal Cortex, Epileptic	Uni-ZAP XR	LP04
HFAA HFAB HFAC HFAD HFAE	Alzheimers, spongy change	Uni-ZAP XR	LP04
HFAM	Frontal Lobe, Dementia	Uni-ZAP XR	LP04
HMIA HMIB HMIC	Human Manic Depression Tissue	Uni-ZAP XR	LP04
HTSA HTSE HTSF HTSG HTSH	Human Thymus	pBS	LP05
HPBA HPBB HPBC HPBD HPBE	Human Pineal Gland	pBS	LP05
HSAA HSAB HSAC	HSA 172 Cells	pBS	LP05
HSBA HSBB HSBC HSBM	HSC172 cells	pBS	LP05
HJAA HJAB HJAC HJAD	Jurkat T-cell G1 phase	pBS	LP05
HJBA HJBB HJBC HJBD	Jurkat T-Cell, S phase	pBS	LP05
HAFA HAFB	Aorta endothelial cells + TNF-a	pBS	LP05
HAWA HAWB HAWC	Human White Adipose	pBS	LP05
HTNA HTNB	Human Thyroid	pBS	LP05
HONA	Normal Ovary, Premenopausal	pBS	LP05
HARA HARB	Human Adult Retina	pBS	LP05
HLJA HLJB	Human Lung	pCMVSPORT 1	LP06
HOFM HOFN HOFO	H. Ovarian Tumor, II, OV5232	pCMVSPORT 2.0	LP07
HOGA HOGB HOGC	OV 10-3-95	pCMVSPORT 2.0	LP07
HCGL	CD34+cells, II	pCMVSPORT 2.0	LP07
HDLA	Hodgkin's Lymphoma I	pCMVSPORT 2.0	LP07
HDTA HDTB HDTC HDTD HDTE	Hodgkin's Lymphoma II	pCMVSPORT 2.0	LP07
HKAA HKAB HKAC HKAD HKAH HKAF HKAG HKAH	Keratinocyte	pCMVSPORT2.0	LP07
HCIM	CAPFINDER, Crohn's Disease, lib 2	pCMVSPORT 2.0	LP07
HKAL	Keratinocyte, lib 2	pCMVSPORT2.0	LP07
HKAT	Keratinocyte, lib 3	pCMVSPORT2.0	LP07
HNDA	Nasal polyps	pCMVSPORT2.0	LP07
HDRA	H. Primary Dendritic Cells, lib 3	pCMVSPORT2.0	LP07
HOHA HOHB HOHC	Human Osteoblasts II	pCMVSPORT2.0	LP07
HLDA HLDB HLDC	Liver, Hepatoma	pCMVSPORT3.0	LP08

Libraries owned by Catalog	Catalog Description	Vector	ATCC Deposit
HLDN HLDO HLDP	Human Liver, normal	pCMVSPORT3.0	LP08
HMTA	pBMC stimulated w/ poly I/C	pCMVSPORT3.0	LP08
HNTA	NTERA2, control	pCMVSPORT3.0	LP08
HDP A HDPB HDPC HDPD HDPF HDPG HDPH HDPI HDPJ HDPK	Primary Dendritic Cells, lib 1	pCMVSPORT3.0	LP08
HDPM HDPN HDPO HDPP	Primary Dendritic cells, frac 2	pCMVSPORT3.0	LP08
HMUA HMUB HMUC	Myeloid Progenitor Cell Line	pCMVSPORT3.0	LP08
HHEA HHEB HHEC HHED	T Cell helper I	pCMVSPORT3.0	LP08
HHEM HHEN HHEO HHEP	T cell helper II	pCMVSPORT3.0	LP08
HEQA HEQB HEQC	Human endometrial stromal cells	pCMVSPORT3.0	LP08
HJMA HJMB	Human endometrial stromal cells- treated with progesterone	pCMVSPORT3.0	LP08
HSWA HSWB HSWC	Human endometrial stromal cells- treated with estradiol	pCMVSPORT3.0	LP08
HSYA HSYB HSYC	Human Thymus Stromal Cells	pCMVSPORT3.0	LP08
HLWA HLWB HLWC	Human Placenta	pCMVSPORT3.0	LP08
HRAA HRAB HRAC	Rejected Kidney, lib 4	pCMVSPORT3.0	LP08
HMTM	PCR, pBMC I/C treated	PCR II	LP09
HMJA	H. Meningioma, M6	pSport 1	LP10
HMKA HMKB HMKC HMKD HMKE	H. Meningioma, M1	pSport 1	LP10
HUSG HUSI	Human umbilical vein endothelial cells, IL-4 induced	pSport 1	LP10
HUSX HUSY	Human Umbilical Vein Endothelial Cells, uninduced	pSport 1	LP10
HOFA	Ovarian Tumor I, OV5232	pSport 1	LP10
HCFA HCFB HCFC HCFD	T-Cell PHA 16 hrs	pSport 1	LP10
HCFL HCFM HCFN HCFO	T-Cell PHA 24 hrs	pSport 1	LP10
HADA HADC HADD HADE HADG	Human Adipose	pSport 1	LP10
HOVA HOVB HOVC	Human Ovary	pSport 1	LP10
HTWB HTWC HTWD HTWE HTWF	Resting T-Cell Library, II	pSport 1	LP10
HMMA	Spleen metastatic melanoma	pSport 1	LP10
HLYA HLYB HLYC HLYD HLYE	Spleen, Chronic lymphocytic leukemia	pSport 1	LP10
HCGA	CD34+ cell, I	pSport 1	LP10
HEOM HEON	Human Eosinophils	pSport 1	LP10

Libraries owned by Catalog	Catalog Description	Vector	ATCC Deposit
HTDA	Human Tonsil, Lib 3	pSport 1	LP10
HSPA	Salivary Gland, Lib 2	pSport 1	LP10
HCHA HCHB HCHC	Breast Cancer cell line, MDA 36	pSport 1	LP10
HCHM HCHN	Breast Cancer Cell line, angiogenic	pSport 1	LP10
HCIA	Crohn's Disease	pSport 1	LP10
HDAA HDAB HDAC	HEL cell line	pSport 1	LP10
HABA	Human Astrocyte	pSport 1	LP10
HUFA HUFB HUFC	Ulcerative Colitis	pSport 1	LP10
HNTM	NTERA2 + retinoic acid, 14 days	pSport 1	LP10
HDQA	Primary Dendritic cells, CapFinder2, frac 1	pSport 1	LP10
HDQM	Primary Dendritic Cells, CapFinder, frac 2	pSport 1	LP10
HLDX	Human Liver, normal,	pSport 1	LP10
HULA HULB HULC	Human Dermal Endothelial Cells, untreated	pSport 1	LP10
HUMA	Human Dermal Endothelial cells, treated	pSport 1	LP10
HCJA	Human Stromal Endometrial fibroblasts, untreated	pSport 1	LP10
HCJM	Human Stromal endometrial fibroblasts, treated w/ estradiol	pSport 1	LP10
HEDA	Human Stromal endometrial fibroblasts, treated with progesterone	pSport 1	LP10
HFNA	Human ovary tumor cell OV350721	pSport 1	LP10
HKGA HKGB HKGC HKGD	Merkel Cells	pSport 1	LP10
HISA HISB HISC	Pancreas Islet Cell Tumor	pSport 1	LP10
HLSA	Skin, burned	pSport 1	LP10
HBZA	Prostate, BPH, Lib 2	pSport 1	LP10
HBZS	Prostate BPH, Lib 2, subtracted	pSport 1	LP10
HFIA HFIB HFIC	Synovial Fibroblasts (control)	pSport 1	LP10
HFIH HFII HFIJ	Synovial hypoxia	pSport 1	LP10
HFIT HFIU HFIV	Synovial IL-1/TNF stimulated	pSport 1	LP10
HGCA	Mesangial cell, frac 1	pSport 1	LP10
HMVA HMVB HMVC	Bone Marrow Stromal Cell, untreated	pSport 1	LP10
HFIX HFIY HFIZ	Synovial Fibroblasts (IL1/TNF), subt	pSport 1	LP10
HFOX HFOY HFOZ	Synovial hypoxia-RSF subtracted	pSport 1	LP10
HMQA HMQB HMQC HMQD	Human Activated Monocytes	Uni-ZAP XR	LP11
HLIA HLIB HLIC	Human Liver	pCMVSPORT 1	LP012
HHBA HHBB HHBC HHBD	Human Heart	pCMVSPORT 1	LP012

Libraries owned by Catalog	Catalog Description	Vector	ATCC Deposit
HHBE			
HBBA HBBB	Human Brain	pCMVSPORT 1	LP012
HLJA HLJB HLJC HLJD HLJE	Human Lung	pCMVSPORT 1	LP012
HOGA HOGB HOGC	Ovarian Tumor	pCMVSPORT 2.0	LP012
HTJM	Human Tonsils, Lib 2	pCMVSPORT 2.0	LP012
HAMF HAMG	KMH2	pCMVSPORT 3.0	LP012
HAJA HAJB HAJC	L428	pCMVSPORT 3.0	LP012
HWBA HWBB HWBC HWBD HWBE	Dendritic cells, pooled	pCMVSPORT 3.0	LP012
HWAA HWAB HWAC HWAD HWAE	Human Bone Marrow, treated	pCMVSPORT 3.0	LP012
HYAA HYAB HYAC	B Cell lymphoma	pCMVSPORT 3.0	LP012
HWHG HWHH HWHI	Healing groin wound, 6.5 hours post incision	pCMVSPORT 3.0	LP012
HWHP HWHQ HWHR	Healing groin wound; 7.5 hours post incision	pCMVSPORT 3.0	LP012
HARM	Healing groin wound - zero hr post-incision (control)	pCMVSPORT 3.0	LP012
HBIM	Olfactory epithelium; nasal cavity	pCMVSPORT 3.0	LP012
HWDA	Healing Abdomen wound; 70&90 min post incision	pCMVSPORT 3.0	LP012
HWEA	Healing Abdomen Wound; 15 days post incision	pCMVSPORT 3.0	LP012
HWJA	Healing Abdomen Wound; 21&29 days	pCMVSPORT 3.0	LP012
HNAL	Human Tongue, frac 2	pSport1	LP012
HMJA	H. Meningioma, M6	pSport1	LP012
HMKA HMKB HMKC HMKD HMKE	H. Meningioma, M1	pSport1	LP012
HOFA	Ovarian Tumor 1, OV5232	pSport1	LP012
HCFA HCFB HCFC HCFD	T-Cell PHA 16 hrs	pSport1	LP012
HCFL HCFM HCFN HCFO	T-Cell PHA 24 hrs	pSport1	LP012
HMMA HMMB HMMC	Spleen metastatic melanoma	pSport1	LP012
HTDA	Human Tonsil, Lib 3	pSport1	LP012
HDBA	Human Fetal Thymus	pSport1	LP012
HDLA	Pericardium	pSport1	LP012
HBZA	Prostate, BPH, Lib 2	pSport1	LP012
HWCA	Larynx tumor	pSport1	LP012
HWKA	Normal lung	pSport1	LP012
HSMB	Bone marrow stroma, treated	pSport1	LP012

Libraries owned by Catalog	Catalog Description	Vector	ATCC Deposit
HBHM	Normal trachea	pSport1	LP012
HLFC	Human Larynx	pSport1	LP012
HLRB	Siebben Polyposis	pSport1	LP012
HNIA	Mammary Gland	pSport1	LP012
HNJB	Palate carcinoma	pSport1	LP012
HNKA	Palate normal	pSport1	LP012
HMZA	Pharynx carcinoma	pSport1	LP012
HABG	Cheek Carcinoma	pSport1	LP012
HMZM	Pharynx Carcinoma	pSport1	LP012
HDRM	Larynx Carcinoma	pSport1	LP012
HVAA	Pancreas normal PCA4 No	pSport1	LP012
HICA	Tongue carcinoma	pSport1	LP012
HUKA HUKB HUKC HUKD HUKE	Human Uterine Cancer	Lambda ZAP II	LP013
HFFA	Human Fetal Brain, random primed	Lambda ZAP II	LP013
HTUA	Activated T-cell labeled with 4-thioluri	Lambda ZAP II	LP013
HBQA	Early Stage Human Brain, random primed	Lambda ZAP II	LP013
HMEB	Human microvascular Endothelial cells, fract. B	Lambda ZAP II	LP013
HUSH	Human Umbilical Vein Endothelial cells, fract. A, re-excision	Lambda ZAP II	LP013
HLQC HLQD	Hepatocellular tumor, re-excision	Lambda ZAP II	LP013
HTWJ HTWK HTWL	Resting T-cell, re-excision	Lambda ZAP II	LP013
HF6S	Human Whole 6 week Old Embryo (II), subt	pBluescript	LP013
HHPS	Human Hippocampus, subtracted	pBluescript	LP013
HL1S	LNCAP, differential expression	pBluescript	LP013
HLHS HLHT	Early Stage Human Lung, Subtracted	pBluescript	LP013
HSUS	Supt cells, cyclohexamide treated, subtracted	pBluescript	LP013
HSUT	Supt cells, cyclohexamide treated, differentially expressed	pBluescript	LP013
HSDS	H. Striatum Depression, subtracted	pBluescript	LP013
HPTZ	Human Pituitary, Subtracted VII	pBluescript	LP013
HSDX	H. Striatum Depression, subt II	pBluescript	LP013
HSDZ	H. Striatum Depression, subt	pBluescript	LP013
HPBA HPBB HPBC HPBD HPBE	Human Pineal Gland	pBluescript SK-	LP013
HRTA	Colorectal Tumor	pBluescript SK-	LP013

Libraries owned by Catalog	Catalog Description	Vector	ATCC Deposit
HSBA HSBB HSBC HSBM	HSC172 cells	pBluescript SK-	LP013
HJAA HJAB HJAC HJAD	Jurkat T-cell G1 phase	pBluescript SK-	LP013
HJBA HJBB HJBC HJBD	Jurkat T-cell, S1 phase	pBluescript SK-	LP013
HTNA HTNB	Human Thyroid	pBluescript SK-	LP013
HAHA HAHB	Human Adult Heart	Uni-ZAP XR	LP013
HE6A	Whole 6 week Old Embryo	Uni-ZAP XR	LP013
HFCA HFCB HFCC HFCD HFCE	Human Fetal Brain	Uni-ZAP XR	LP013
HFKE HFKE HFKE HFKE HFKE	Human Fetal Kidney	Uni-ZAP XR	LP013
HGBA HGBD HGBE HGBF HGBG	Human Gall Bladder	Uni-ZAP XR	LP013
HPRA HPRB HPRC HPRD	Human Prostate	Uni-ZAP XR	LP013
HTEA HTEB HTEC HTED HTEE	Human Testes	Uni-ZAP XR	LP013
HTTA HTTB HTTC HTTD HTTE	Human Testes Tumor	Uni-ZAP XR	LP013
HYBA HYBB	Human Fetal Bone	Uni-ZAP XR	LP013
HFLA	Human Fetal Liver	Uni-ZAP XR	LP013
HHFB HHFC HHFD HHFE HHFF	Human Fetal Heart	Uni-ZAP XR	LP013
HUVB HUV C HUV D HUV E	Human Umbilical Vein, End. remake	Uni-ZAP XR	LP013
HTHB HTHC HTHD	Human Thymus	Uni-ZAP XR	LP013
HSTA HSTB HSTC HSTD	Human Skin Tumor	Uni-ZAP XR	LP013
HTAA HTAB HTAC HTAD HTAE	Human Activated T-cells	Uni-ZAP XR	LP013
HFEA HFEB HFEC	Human Fetal Epithelium (skin)	Uni-ZAP XR	LP013
HJPA HJPB HJPC HJPD	Human Jurkat Membrane Bound Polysomes	Uni-ZAP XR	LP013
HESA	Human Epithelioid Sarcoma	Uni-ZAP XR	LP013
HALS	Human Adult Liver, Subtracted	Uni-ZAP XR	LP013
HFTA HFTB HFTC HFTD	Human Fetal Dura Mater	Uni-ZAP XR	LP013
HCAA HCAB HCAC	Cem cells, cyclohexamide treated	Uni-ZAP XR	LP013
HRGA HRGB HRGC HRGD	Raji Cells, cyclohexamide treated	Uni-ZAP XR	LP013
HE9A HE9B HE9C HE9D HE9E	Nine Week Old Early Stage Human	Uni-ZAP XR	LP013
HSFA	Human Fibrosarcoma	Uni-ZAP XR	LP013
HATA HATB HATC HATD HATE	Human Adrenal Gland Tumor	Uni-ZAP XR	LP013
HTRA	Human Trachea Tumor	Uni-ZAP XR	LP013
HE2A HE2D HE2E HE2H HE2I	12 Week Old Early Stage Human	Uni-ZAP XR	LP013
HE2B HE2C HE2F HE2G HE2P	12 Week Old Early Stage Human, II	Uni-ZAP XR	LP013
HNEA HNEB HNEC HNEE	Human Neutrophil	Uni-ZAP XR	LP013

Libraries owned by Catalog	Catalog Description	Vector	ATCC Deposit
HBGA	Human Primary Breast Cancer	Uni-ZAP XR	LP013
HPTS HPTT HPTU	Human Pituitary, subtracted	Uni-ZAP XR	LP013
HMQA HMQB HMQC HMQD	Human Activated Monocytes	Uni-ZAP XR	LP013
HOAA HOAB HOAC	Human Osteosarcoma	Uni-ZAP XR	LP013
HTOA HTOD HTOE HTOF HTOG	human tonsils	Uni-ZAP XR	LP013
HMGB	Human OB MG63 control fraction I	Uni-ZAP XR	LP013
HOPB	Human OB HOS control fraction I	Uni-ZAP XR	LP013
HOQB	Human OB HOS treated (1 nM E2) fraction I	Uni-ZAP XR	LP013
HAUA HAUB HAUC	Amniotic Cells - TNF induced	Uni-ZAP XR	LP013
HAQA HAQB HAQC HAQD	Amniotic Cells - Primary Culture	Uni-ZAP XR	LP013
HROA HROC	HUMAN STOMACH	Uni-ZAP XR	LP013
HBJA HBJB HBJC HBJD HBJE	HUMAN B CELL LYMPHOMA	Uni-ZAP XR	LP013
HODA HODB HODC HODD	human ovarian cancer	Uni-ZAP XR	LP013
HCPA	Corpus Callosum	Uni-ZAP XR	LP013
HSOA	stomach cancer (human)	Uni-ZAP XR	LP013
HERA	SKIN	Uni-ZAP XR	LP013
HMDA	Brain-medulloblastoma	Uni-ZAP XR	LP013
HGLA HGLB HGLD	Glioblastoma	Uni-ZAP XR	LP013
HWTA HWTB HWTC	wilm's tumor	Uni-ZAP XR	LP013
HEAA	H. Atrophic Endometrium	Uni-ZAP XR	LP013
HAPN HAPO HAPPP HAPQ HAPR	Human Adult Pulmonary;re-excision	Uni-ZAP XR	LP013
HLTG HLTH	Human T-cell lymphoma;re-excision	Uni-ZAP XR	LP013
HAHC HAHD HAHE	Human Adult Heart;re-excision	Uni-ZAP XR	LP013
HAGA HAGB HAGC HAGD HAGE	Human Amygdala	Uni-ZAP XR	LP013
HSJA HSJB HSJC	Smooth muscle-ILb induced	Uni-ZAP XR	LP013
HSJA HSJB HSJC	Smooth muscle, IL1b induced	Uni-ZAP XR	LP013
HPWA HPWB HPWC HPWD HPWE	Prostate BPH	Uni-ZAP XR	LP013
HPJA HPJB HPJC	LNCAP prostate cell line	Uni-ZAP XR	LP013
HPJA HPJB HPJC	PC3 Prostate cell line	Uni-ZAP XR	LP013
HBTA	Bone Marrow Stroma, TNF&LPS ind	Uni-ZAP XR	LP013
HMCF HMCB HMCH HMCJ HMCJ	Macrophage-oxLDL; re-excision	Uni-ZAP XR	LP013
HAGG HAGH HAGI	Human Amygdala;re-excision	Uni-ZAP XR	LP013
HACA	H. Adipose Tissue	Uni-ZAP XR	LP013

Libraries owned by Catalog	Catalog Description	Vector	ATCC Deposit
HKFB	K562 + PMA (36 hrs),re-excision	ZAP Express	LP013
HCWT HCWU HCWV	CD34 positive cells (cord blood),re-ex	ZAP Express	LP013
HBWA	Whole brain	ZAP Express	LP013
HBXA HBXB HBXC HBXD	Human Whole Brain #2 - Oligo dT > 1.5Kb	ZAP Express	LP013
HAVM	Temporal cortex-Alzheimer	pT-Adv	LP014
HAVT	Hippocampus, Alzheimer Subtracted	pT-Adv	LP014
HHAS	CHME Cell Line	Uni-ZAP XR	LP014
HAJR	Larynx normal	pSport 1	LP014
HWLE HWLF HWLG HWLH	Colon Normal	pSport 1	LP014
HCRM HCRN HCRO	Colon Carcinoma	pSport 1	LP014
HWLI HWLJ HWLK	Colon Normal	pSport 1	LP014
HWLQ HWLR HWLS HWLT	Colon Tumor	pSport 1	LP014
HBFM	Gastrocnemius Muscle	pSport 1	LP014
HBOD HBOE	Quadriceps Muscle	pSport 1	LP014
HBKD HBKE	Soleus Muscle	pSport 1	LP014
HCCM	Pancreatic Langerhans	pSport 1	LP014
HWGA	Larynx carcinoma	pSport 1	LP014
HWGM HWGN	Larynx carcinoma	pSport 1	LP014
HWLA HWLB HWLC	Normal colon	pSport 1	LP014
HWLM HWLN	Colon Tumor	pSport 1	LP014
HVAM HVAN HVAO	Pancreas Tumor	pSport 1	LP014
HWGQ	Larynx carcinoma	pSport 1	LP014
HAQM HAQN	Salivary Gland	pSport 1	LP014
HASM	Stomach; normal	pSport 1	LP014
HBCM	Uterus; normal	pSport 1	LP014
HCDM	Testis; normal	pSport 1	LP014
HDJM	Brain; normal	pSport 1	LP014
HEFM	Adrenal Gland,normal	pSport 1	LP014
HBAA	Rectum normal	pSport 1	LP014
HFDm	Rectum tumour	pSport 1	LP014
HGAM	Colon, normal	pSport 1	LP014
HHMM	Colon, tumour	pSport 1	LP014
HCLB HCLC	Human Lung Cancer	Lambda Zap II	LP015
HRLA	L1 Cell line	ZAP Express	LP015
HHAM	Hypothalamus, Alzheimer's	pCMVSPORT 3.0	LP015
HKBA	Ku 812F Basophils Line	pSport 1	LP015
HS2S	Saos2, Dexamethosome Treated	pSport 1	LP016

Libraries owned by Catalog	Catalog Description	Vector	ATCC Deposit
HA5A	Lung Carcinoma A549 TNFalpha activated	pSport 1	LP016
HTFM	TF-1 Cell Line GM-CSF Treated	pSport 1	LP016
HYAS	Thyroid Tumour	pSport 1	LP016
HUTS	Larynx Normal	pSport 1	LP016
HXOA	Larynx Tumor	pSport 1	LP016
HEAH	Ea.hy.926 cell line	pSport 1	LP016
HINA	Adenocarcinoma Human	pSport 1	LP016
HRMA	Lung Mesothelium	pSport 1	LP016
HLCL	Human Pre-Differentiated Adipocytes	Uni-Zap XR	LP017
HS2A	Saos2 Cells	pSport 1	LP020
HS2I	Saos2 Cells; Vitamin D3 Treated	pSport 1	LP020
HUCM	CHME Cell Line, untreated	pSport 1	LP020
HEPN	Aryepiglottis Normal	pSport 1	LP020
HPSN	Sinus Piniformis Tumour	pSport 1	LP020
HNSA	Stomach Normal	pSport 1	LP020
HNSM	Stomach Tumour	pSport 1	LP020
HNLA	Liver Normal Met5No	pSport 1	LP020
HUTA	Liver Tumour Met 5 Tu	pSport 1	LP020
HOCN	Colon Normal	pSport 1	LP020
HOCT	Colon Tumor	pSport 1	LP020
HTNT	Tongue Tumour	pSport 1	LP020
HLXN	Larynx Normal	pSport 1	LP020
HLXT	Larynx Tumour	pSport 1	LP020
HTYN	Thymus	pSport 1	LP020
HPLN	Placenta	pSport 1	LP020
HTNG	Tongue Normal	pSport 1	LP020
HZAA	Thyroid Normal (SDCA2 No)	pSport 1	LP020
HWES	Thyroid Thyroiditis	pSport 1	LP020
HFHD	Ficoll Human Stromal Cells, 5Fu treated	pTrip1 Ex2	LP021
HFHM, HFHN	Ficoll Human Stromal Cells, Untreated	pTrip1 Ex2	LP021
HPCI	Hep G2 Cells, lambda library	lambda Zap-CMV XR	LP021
HBCA, HBCB, HBCC	H. Lymph node breast Cancer	Uni-ZAP XR	LP021
HCOK	Chondrocytes	pSPORT1	LP022
HDCA, HDCB, HDCC	Dendritic Cells From CD34 Cells	pSPORT1	LP022

Libraries owned by Catalog	Catalog Description	Vector	ATCC Deposit
HDMA, HDMB	CD40 activated monocyte dendritic cells	pSPORT1	LP022
HDDM, HDDN, HDDO	LPS activated derived dendritic cells	pSPORT1	LP022
HPCR	Hep G2 Cells, PCR library	lambda Zap-CMV XR	LP022
HAAA, HAAB, HAAC	Lung, Cancer (4005313 A3): Invasive Poorly Differentiated Lung Adenocarcinoma	pSPORT1	LP022
HIPA, HIPB, HIPC	Lung, Cancer (4005163 B7): Invasive, Poorly Diff. Adenocarcinoma, Metastatic	pSPORT1	LP022
HOOH, HOOI	Ovary, Cancer: (4004562 B6) Papillary Serous Cystic Neoplasm, Low Malignant Pot	pSPORT1	LP022
HIDA	Lung, Normal: (4005313 B1)	pSPORT1	LP022
HUJA, HUJB, HUJC, HUJD, HUJE	B-Cells	pCMVSPORT 3.0	LP022
HNOA, HNOB, HNOC, HNOD	Ovary, Normal: (9805C040R)	pSPORT1	LP022
HNLM	Lung, Normal: (4005313 B1)	pSPORT1	LP022
HSCL	Stromal Cells	pSPORT1	LP022
HAAX	Lung, Cancer: (4005313 A3) Invasive Poorly-differentiated Metastatic lung adenocarcinoma	pSPORT1	LP022
HUUA, HUUB, HUUC, HUUD	B-cells (unstimulated)	pTrip1Ex2	LP022
HWWA, HWWB, HWWC, HWWD, HWWE, HWWF, HWWG	B-cells (stimulated)	pSPORT1	LP022
HCCC	Colon, Cancer: (9808C064R)	pCMVSPORT 3.0	LP023
HPDO HPDP HPDQ HPDR HPD	Ovary, Cancer (9809C332): Poorly differentiated adenocarcinoma	pSport 1	LP023
HPCO HPCP HPCQ HPCT	Ovary, Cancer (15395A1F): Grade II Papillary Carcinoma	pSport 1	LP023
HOCM HOCO HOC P HOCQ	Ovary, Cancer: (15799A1F) Poorly differentiated carcinoma	pSport 1	LP023
HCBM HCBN HCBO	Breast, Cancer: (4004943 A5)	pSport 1	LP023
HNBT HNBU HNBV	Breast, Normal: (4005522B2)	pSport 1	LP023
HBCP HBCQ	Breast, Cancer: (4005522 A2)	pSport 1	LP023
HBCJ	Breast, Cancer: (9806C012R)	pSport 1	LP023
HSAM HSAN	Stromal cells 3.88	pSport 1	LP023
HVCA HVCB HVCC HVCD	Ovary, Cancer: (4004332 A2)	pSport 1	LP023
HSCK HSEN HSEO	Stromal cells (HBM3.18)	pSport 1	LP023

Libraries owned by Catalog	Catalog Description	Vector	ATCC Deposit
HSCP HSCQ	stromal cell clone 2.5	pSport 1	LP023
HUXA	Breast Cancer: (4005385 A2)	pSport 1	LP023
HCOM HCON HCOO HCOP HCOQ	Ovary, Cancer (4004650 A3): Well-Differentiated Micropapillary Serous Carcinoma	pSport 1	LP023
HBNM	Breast, Cancer: (9802C020E)	pSport 1	LP023
HVVA HVVB HVVC HVVD HVVE	Human Bone Marrow, treated	pSport 1	LP023

[0888] Two nonlimiting examples are provided below for isolating a particular clone from the deposited sample of plasmid cDNAs cited for that clone in Table 7. First, a plasmid is directly isolated by screening the clones using a polynucleotide probe corresponding to the nucleotide sequence of SEQ ID NO:X.

[0889] Particularly, a specific polynucleotide with 30-40 nucleotides is synthesized using an Applied Biosystems DNA synthesizer according to the sequence reported. The oligonucleotide is labeled, for instance, with ^{32}P - γ -ATP using T4 polynucleotide kinase and purified according to routine methods. (E.g., Maniatis et al., Molecular Cloning: A Laboratory Manual, Cold Spring Harbor Press, Cold Spring, NY (1982).) The plasmid mixture is transformed into a suitable host, as indicated above (such as XL-1 Blue (Stratagene)) using techniques known to those of skill in the art, such as those provided by the vector supplier or in related publications or patents cited above. The transformants are plated on 1.5% agar plates (containing the appropriate selection agent, e.g., ampicillin) to a density of about 150 transformants (colonies) per plate. These plates are screened using Nylon membranes according to routine methods for bacterial colony screening (e.g., Sambrook et al., Molecular Cloning: A Laboratory Manual, 2nd Edit., (1989), Cold Spring Harbor Laboratory Press, pages 1.93 to 1.104), or other techniques known to those of skill in the art.

[0890] Alternatively, two primers of 17-20 nucleotides derived from both ends of the nucleotide sequence of SEQ ID NO:X are synthesized and used to amplify the desired cDNA using the deposited cDNA plasmid as a template. The polymerase chain reaction is carried out under routine conditions, for instance, in 25 μl of reaction mixture with 0.5 μg of the above cDNA template. A convenient reaction mixture is

1.5-5 mM MgCl₂, 0.01% (w/v) gelatin, 20 µM each of dATP, dCTP, dGTP, dTTP. 25 pmol of each primer and 0.25 Unit of Taq polymerase. Thirty five cycles of PCR (denaturation at 94°C for 1 min; annealing at 55°C for 1 min; elongation at 72°C for 1 min) are performed with a Perkin-Elmer Cetus automated thermal cycler. The amplified product is analyzed by agarose gel electrophoresis and the DNA band with expected molecular weight is excised and purified. The PCR product is verified to be the selected sequence by subcloning and sequencing the DNA product.

[0891] Several methods are available for the identification of the 5' or 3' non-coding portions of a gene which may not be present in the deposited clone. These methods include but are not limited to, filter probing, clone enrichment using specific probes, and protocols similar or identical to 5' and 3' "RACE" protocols which are well known in the art. For instance, a method similar to 5' RACE is available for generating the missing 5' end of a desired full-length transcript. (Fromont-Racine et al., Nucleic Acids Res. 21(7):1683-1684 (1993).)

[0892] Briefly, a specific RNA oligonucleotide is ligated to the 5' ends of a population of RNA presumably containing full-length gene RNA transcripts. A primer set containing a primer specific to the ligated RNA oligonucleotide and a primer specific to a known sequence of the gene of interest is used to PCR amplify the 5' portion of the desired full-length gene. This amplified product may then be sequenced and used to generate the full length gene.

[0893] This above method starts with total RNA isolated from the desired source, although poly-A⁺ RNA can be used. The RNA preparation can then be treated with phosphatase if necessary to eliminate 5' phosphate groups on degraded or damaged RNA which may interfere with the later RNA ligase step. The phosphatase should then be inactivated and the RNA treated with tobacco acid pyrophosphatase in order to remove the cap structure present at the 5' ends of messenger RNAs. This reaction leaves a 5' phosphate group at the 5' end of the cap cleaved RNA which can then be ligated to an RNA oligonucleotide using T4 RNA ligase.

[0894] This modified RNA preparation is used as a template for first strand cDNA synthesis using a gene specific oligonucleotide. The first strand synthesis reaction is used as a template for PCR amplification of the desired 5' end using a primer specific to the ligated RNA oligonucleotide and a primer specific to the known sequence of the

gene of interest. The resultant product is then sequenced and analyzed to confirm that the 5' end sequence belongs to the desired gene.

Example 2: Isolation of Genomic Clones Corresponding to a Polynucleotide

[0895] A human genomic PI library (Genomic Systems, Inc.) is screened by PCR using primers selected for the sequence corresponding to SEQ ID NO:X according to the method described in Example 1. (See also, Sambrook et al., Molecular Cloning: A Laboratory Manual, 2nd Edn., (1989), Cold Spring Harbor Laboratory Press).

Example 3: Tissue specific expression analysis

[0896] The Human Genome Sciences, Inc. (HGS) database is derived from sequencing tissue and/or disease specific cDNA libraries. Libraries generated from a particular tissue are selected and the specific tissue expression pattern of EST groups or assembled contigs within these libraries is determined by comparison of the expression patterns of those groups or contigs within the entire database. ESTs and assembled contigs which show tissue specific expression are selected.

[0897] The original clone from which the specific EST sequence was generated, or in the case of an assembled contig, the clone from which the 5' most EST sequence was generated, is obtained from the catalogued library of clones and the insert amplified by PCR using methods known in the art. The PCR product is denatured and then transferred in 96 or 384 well format to a nylon membrane (Schleicher and Scheull) generating an array filter of tissue specific clones. Housekeeping genes, maize genes, and known tissue specific genes are included on the filters. These targets can be used in signal normalization and to validate assay sensitivity. Additional targets are included to monitor probe length and specificity of hybridization.

[0898] Radioactively labeled hybridization probes are generated by first strand cDNA synthesis per the manufacturer's instructions (Life Technologies) from mRNA/RNA samples prepared from the specific tissue being analyzed (e.g.,

reproductive system, cancers of the reproductive system, or, more specifically, prostate, prostate cancer, ovarian, ovarian cancer, etc.). The hybridization probes are purified by gel exclusion chromatography, quantitated, and hybridized with the array filters in hybridization bottles at 65°C overnight. The filters are washed under stringent conditions and signals are captured using a Fuji phosphorimager.

[0899] Data is extracted using AIS software and following background subtraction, signal normalization is performed. This includes a normalization of filter-wide expression levels between different experimental runs. Genes that are differentially expressed in the tissue of interest are identified.

Example 4: Chromosomal Mapping of the Polynucleotides

[0900] An oligonucleotide primer set is designed according to the sequence at the 5' end of SEQ ID NO:X. This primer preferably spans about 100 nucleotides. This primer set is then used in a polymerase chain reaction under the following set of conditions: 30 seconds, 95°C; 1 minute, 56°C; 1 minute, 70°C. This cycle is repeated 32 times followed by one 5 minute cycle at 70°C. Human, mouse, and hamster DNA is used as template in addition to a somatic cell hybrid panel containing individual chromosomes or chromosome fragments (Bios, Inc). The reactions are analyzed on either 8% polyacrylamide gels or 3.5 % agarose gels. Chromosome mapping is determined by the presence of an approximately 100 bp PCR fragment in the particular somatic cell hybrid.

Example 5: Bacterial Expression of a Polypeptide

[0901] A polynucleotide encoding a polypeptide of the present invention is amplified using PCR oligonucleotide primers corresponding to the 5' and 3' ends of the DNA sequence, as outlined in Example 1, to synthesize insertion fragments. The primers used to amplify the cDNA insert should preferably contain restriction sites, such as BamHI and XbaI, at the 5' end of the primers in order to clone the amplified

product into the expression vector. For example, BamHI and XbaI correspond to the restriction enzyme sites on the bacterial expression vector pQE-9. (Qiagen, Inc., Chatsworth, CA). This plasmid vector encodes antibiotic resistance (Amp^r), a bacterial origin of replication (*ori*), an IPTG-regulatable promoter/operator (P/O), a ribosome binding site (RBS), a 6-histidine tag (6-His), and restriction enzyme cloning sites.

[0902] The pQE-9 vector is digested with BamHI and XbaI and the amplified fragment is ligated into the pQE-9 vector maintaining the reading frame initiated at the bacterial RBS. The ligation mixture is then used to transform the *E. coli* strain M15/rep4 (Qiagen, Inc.) which contains multiple copies of the plasmid pREP4, which expresses the *lacI* repressor and also confers kanamycin resistance (Kan^r). Transformants are identified by their ability to grow on LB plates and ampicillin/kanamycin resistant colonies are selected. Plasmid DNA is isolated and confirmed by restriction analysis.

[0903] Clones containing the desired constructs are grown overnight (O/N) in liquid culture in LB media supplemented with both Amp (100 μ g/ml) and Kan (25 μ g/ml). The O/N culture is used to inoculate a large culture at a ratio of 1:100 to 1:250. The cells are grown to an optical density 600 (O.D.⁶⁰⁰) of between 0.4 and 0.6. IPTG (Isopropyl-B-D-thiogalacto pyranoside) is then added to a final concentration of 1 mM. IPTG induces by inactivating the *lacI* repressor, clearing the P/O leading to increased gene expression.

[0904] Cells are grown for an extra 3 to 4 hours. Cells are then harvested by centrifugation (20 mins at 6000Xg). The cell pellet is solubilized in the chaotropic agent 6 Molar Guanidine HCl by stirring for 3-4 hours at 4°C. The cell debris is removed by centrifugation, and the supernatant containing the polypeptide is loaded onto a nickel-nitrilo-tri-acetic acid ("Ni-NTA") affinity resin column (available from QIAGEN, Inc., *supra*). Proteins with a 6 x His tag bind to the Ni-NTA resin with high affinity and can be purified in a simple one-step procedure (for details see: The QIAexpressionist (1995) QIAGEN, Inc., *supra*).

[0905] Briefly, the supernatant is loaded onto the column in 6 M guanidine-HCl, pH 8. The column is first washed with 10 volumes of 6 M guanidine-HCl, pH 8, then

washed with 10 volumes of 6 M guanidine-HCl pH 6, and finally the polypeptide is eluted with 6 M guanidine-HCl, pH 5.

[0906] The purified protein is then renatured by dialyzing it against phosphate-buffered saline (PBS) or 50 mM Na-acetate, pH 6 buffer plus 200 mM NaCl. Alternatively, the protein can be successfully refolded while immobilized on the Ni-NTA column. The recommended conditions are as follows: renature using a linear 6M-1M urea gradient in 500 mM NaCl, 20% glycerol, 20 mM Tris/HCl pH 7.4, containing protease inhibitors. The renaturation should be performed over a period of 1.5 hours or more. After renaturation the proteins are eluted by the addition of 250 mM imidazole. Imidazole is removed by a final dialyzing step against PBS or 50 mM sodium acetate pH 6 buffer plus 200 mM NaCl. The purified protein is stored at 4°C or frozen at -80°C.

[0907] In addition to the above expression vector, the present invention further includes an expression vector, called pHE4a (ATCC Accession Number 209645, deposited on February 25, 1998) which contains phage operator and promoter elements operatively linked to a polynucleotide of the present invention. This vector contains: 1) a neomycinphosphotransferase gene as a selection marker, 2) an E. coli origin of replication, 3) a T5 phage promoter sequence, 4) two lac operator sequences, 5) a Shine-Delgarno sequence, and 6) the lactose operon repressor gene (lacIq). The origin of replication (oriC) is derived from pUC19 (LTI, Gaithersburg, MD). The promoter and operator sequences are made synthetically.

[0908] DNA can be inserted into the pHE4a by restricting the vector with NdeI and XbaI, BamHI, XhoI, or Asp718, running the restricted product on a gel, and isolating the larger fragment (the stuffer fragment should be about 310 base pairs). The DNA insert is generated according to the PCR protocol described in Example 1, using PCR primers having restriction sites for NdeI (5' primer) and XbaI, BamHI, XhoI, or Asp718 (3' primer). The PCR insert is gel purified and restricted with compatible enzymes. The insert and vector are ligated according to standard protocols.

[0909] The engineered vector could easily be substituted in the above protocol to express protein in a bacterial system.

Example 6: Purification of a Polypeptide from an Inclusion Body

- [0910] The following alternative method can be used to purify a polypeptide expressed in *E. coli* when it is present in the form of inclusion bodies. Unless otherwise specified, all of the following steps are conducted at 4-10°C.
- [0911] Upon completion of the production phase of the *E. coli* fermentation, the cell culture is cooled to 4-10°C and the cells harvested by continuous centrifugation at 15,000 rpm (Heraeus Sepatech). On the basis of the expected yield of protein per unit weight of cell paste and the amount of purified protein required, an appropriate amount of cell paste, by weight, is suspended in a buffer solution containing 100 mM Tris, 50 mM EDTA, pH 7.4. The cells are dispersed to a homogeneous suspension using a high shear mixer.
- [0912] The cells are then lysed by passing the solution through a microfluidizer (Microfluidics, Corp. or APV Gaulin, Inc.) twice at 4000-6000,psi. The homogenate is then mixed with NaCl solution to a final concentration of 0.5 M NaCl, followed by centrifugation at 7000 xg for 15 min. The resultant pellet is washed again using 0.5M NaCl, 100 mM Tris, 50 mM EDTA, pH 7.4.
- [0913] The resulting washed inclusion bodies are solubilized with 1.5 M guanidine hydrochloride (GuHCl) for 2-4 hours. After 7000 xg centrifugation for 15 min., the pellet is discarded and the polypeptide containing supernatant is incubated at 4°C overnight to allow further GuHCl extraction.
- [0914] Following high speed centrifugation (30,000 xg) to remove insoluble particles, the GuHCl solubilized protein is refolded by quickly mixing the GuHCl extract with 20 volumes of buffer containing 50 mM sodium, pH 4.5, 150 mM NaCl, 2 mM EDTA by vigorous stirring. The refolded diluted protein solution is kept at 4°C without mixing for 12 hours prior to further purification steps.
- [0915] To clarify the refolded polypeptide solution, a previously prepared tangential filtration unit equipped with 0.16 µm membrane filter with appropriate surface area (e.g., Filtron), equilibrated with 40 mM sodium acetate, pH 6.0 is employed. The filtered sample is loaded onto a cation exchange resin (e.g., Poros HS-50, Perseptive Biosystems). The column is washed with 40 mM sodium acetate, pH

6.0 and eluted with 250 mM, 500 mM, 1000 mM, and 1500 mM NaCl in the same buffer, in a stepwise manner. The absorbance at 280 nm of the effluent is continuously monitored. Fractions are collected and further analyzed by SDS-PAGE.

[0916] Fractions containing the polypeptide are then pooled and mixed with 4 volumes of water. The diluted sample is then loaded onto a previously prepared set of tandem columns of strong anion (Poros HQ-50, Perseptive Biosystems) and weak anion (Poros CM-20, Perseptive Biosystems) exchange resins. The columns are equilibrated with 40 mM sodium acetate, pH 6.0. Both columns are washed with 40 mM sodium acetate, pH 6.0, 200 mM NaCl. The CM-20 column is then eluted using a 10 column volume linear gradient ranging from 0.2 M NaCl, 50 mM sodium acetate, pH 6.0 to 1.0 M NaCl, 50 mM sodium acetate, pH 6.5. Fractions are collected under constant A_{280} monitoring of the effluent. Fractions containing the polypeptide (determined, for instance, by 16% SDS-PAGE) are then pooled.

[0917] The resultant polypeptide should exhibit greater than 95% purity after the above refolding and purification steps. No major contaminant bands should be observed from Commassie blue stained 16% SDS-PAGE gel when 5 μ g of purified protein is loaded. The purified protein can also be tested for endotoxin/LPS contamination, and typically the LPS content is less than 0.1 ng/ml according to LAL assays.

Example 7: Cloning and Expression of a Polypeptide in a Baculovirus Expression System

[0918] In this example, the plasmid shuttle vector pA2 is used to insert a polynucleotide into a baculovirus to express a polypeptide. This expression vector contains the strong polyhedrin promoter of the *Autographa californica* nuclear polyhedrosis virus (AcMNPV) followed by convenient restriction sites such as BamHI, Xba I and Asp718. The polyadenylation site of the simian virus 40 ("SV40") is used for efficient polyadenylation. For easy selection of recombinant virus, the plasmid contains the beta-galactosidase gene from *E. coli* under control of a weak *Drosophila* promoter in the same orientation, followed by the polyadenylation signal

of the polyhedrin gene. The inserted genes are flanked on both sides by viral sequences for cell-mediated homologous recombination with wild-type viral DNA to generate a viable virus that express the cloned polynucleotide.

[0919] Many other baculovirus vectors can be used in place of the vector above, such as pAc373, pVL941, and pAcIM1, as one skilled in the art would readily appreciate, as long as the construct provides appropriately located signals for transcription, translation, secretion and the like, including a signal peptide and an in-frame AUG as required. Such vectors are described, for instance, in Luckow et al., *Virology* 170:31-39 (1989).

[0920] Specifically, the cDNA sequence contained in the deposited clone, including the AUG initiation codon, is amplified using the PCR protocol described in Example 1. If a naturally occurring signal sequence is used to produce the polypeptide of the present invention, the pA2 vector does not need a second signal peptide. Alternatively, the vector can be modified (pA2 GP) to include a baculovirus leader sequence, using the standard methods described in Summers et al., "A Manual of Methods for Baculovirus Vectors and Insect Cell Culture Procedures," Texas Agricultural Experimental Station Bulletin No. 1555 (1987).

[0921] The amplified fragment is isolated from a 1% agarose gel using a commercially available kit ("Geneclean," BIO 101 Inc., La Jolla, Ca.). The fragment then is digested with appropriate restriction enzymes and again purified on a 1% agarose gel.

[0922] The plasmid is digested with the corresponding restriction enzymes and optionally, can be dephosphorylated using calf intestinal phosphatase, using routine procedures known in the art. The DNA is then isolated from a 1% agarose gel using a commercially available kit ("Geneclean" BIO 101 Inc., La Jolla, Ca.).

[0923] The fragment and the dephosphorylated plasmid are ligated together with T4 DNA ligase. *E. coli* HB101 or other suitable *E. coli* hosts such as XL-1 Blue (Stratagene Cloning Systems, La Jolla, CA) cells are transformed with the ligation mixture and spread on culture plates. Bacteria containing the plasmid are identified by digesting DNA from individual colonies and analyzing the digestion product by gel electrophoresis. The sequence of the cloned fragment is confirmed by DNA sequencing.

- [0924] Five μg of a plasmid containing the polynucleotide is co-transfected with 1.0 μg of a commercially available linearized baculovirus DNA ("BaculoGold™ baculovirus DNA", Pharmingen, San Diego, CA), using the lipofection method described by Felgner et al., Proc. Natl. Acad. Sci. USA 84:7413-7417 (1987). One μg of BaculoGold™ virus DNA and 5 μg of the plasmid are mixed in a sterile well of a microtiter plate containing 50 μl of serum-free Grace's medium (Life Technologies Inc., Gaithersburg, MD). Afterwards, 10 μl Lipofectin plus 90 μl Grace's medium are added, mixed and incubated for 15 minutes at room temperature. Then the transfection mixture is added drop-wise to Sf9 insect cells (ATCC CRL 1711) seeded in a 35 mm tissue culture plate with 1 ml Grace's medium without serum. The plate is then incubated for 5 hours at 27° C. The transfection solution is then removed from the plate and 1 ml of Grace's insect medium supplemented with 10% fetal calf serum is added. Cultivation is then continued at 27° C for four days.
- [0925] After four days the supernatant is collected and a plaque assay is performed, as described by Summers and Smith, *supra*. An agarose gel with "Blue Gal" (Life Technologies Inc., Gaithersburg) is used to allow easy identification and isolation of gal-expressing clones, which produce blue-stained plaques. (A detailed description of a "plaque assay" of this type can also be found in the user's guide for insect cell culture and baculovirology distributed by Life Technologies Inc., Gaithersburg, page 9-10.) After appropriate incubation, blue stained plaques are picked with the tip of a micropipettor (e.g., Eppendorf). The agar containing the recombinant viruses is then resuspended in a microcentrifuge tube containing 200 μl of Grace's medium and the suspension containing the recombinant baculovirus is used to infect Sf9 cells seeded in 35 mm dishes. Four days later the supernatants of these culture dishes are harvested and then they are stored at 4° C.
- [0926] To verify the expression of the polypeptide, Sf9 cells are grown in Grace's medium supplemented with 10% heat-inactivated FBS. The cells are infected with the recombinant baculovirus containing the polynucleotide at a multiplicity of infection ("MOI") of about 2. If radiolabeled proteins are desired, 6 hours later the medium is removed and is replaced with SF900 II medium minus methionine and cysteine (available from Life Technologies Inc., Rockville, MD). After 42 hours, 5 μCi of ^{35}S -methionine and 5 μCi ^{35}S -cysteine (available from Amersham) are added. The cells

are further incubated for 16 hours and then are harvested by centrifugation. The proteins in the supernatant as well as the intracellular proteins are analyzed by SDS-PAGE followed by autoradiography (if radiolabeled).

[0927] Microsequencing of the amino acid sequence of the amino terminus of purified protein may be used to determine the amino terminal sequence of the produced protein.

Example 8: Expression of a Polypeptide in Mammalian Cells

[0928] The polypeptide of the present invention can be expressed in a mammalian cell. A typical mammalian expression vector contains a promoter element, which mediates the initiation of transcription of mRNA, a protein coding sequence, and signals required for the termination of transcription and polyadenylation of the transcript. Additional elements include enhancers, Kozak sequences and intervening sequences flanked by donor and acceptor sites for RNA splicing. Highly efficient transcription is achieved with the early and late promoters from SV40, the long terminal repeats (LTRs) from Retroviruses, e.g., RSV, HTLV, HIV and the early promoter of the cytomegalovirus (CMV). However, cellular elements can also be used (e.g., the human actin promoter).

[0929] Suitable expression vectors for use in practicing the present invention include, for example, vectors such as pSVL and pMSG (Pharmacia, Uppsala, Sweden), pRSVcat (ATCC 37152), pSV2dhfr (ATCC 37146), pBC12MI (ATCC 67109), pCMVSPORT 2.0, and pCMVSPORT 3.0. Mammalian host cells that could be used include, human HeLa, 293, H9 and Jurkat cells, mouse NIH3T3 and C127 cells, Cos 1, Cos 7 and CV1, quail QC1-3 cells, mouse L cells and Chinese hamster ovary (CHO) cells.

[0930] Alternatively, the polypeptide can be expressed in stable cell lines containing the polynucleotide integrated into a chromosome. The co-transfection with a selectable marker such as DHFR, gpt, neomycin, or hygromycin allows the identification and isolation of the transfected cells.

- [0931] The transfected gene can also be amplified to express large amounts of the encoded protein. The DHFR (dihydrofolate reductase) marker is useful in developing cell lines that carry several hundred or even several thousand copies of the gene of interest. (See, e.g., Alt, F. W., et al., J. Biol. Chem. 253:1357-1370 (1978); Hamlin, J. L. and Ma, C., Biochem. et Biophys. Acta, 1097:107-143 (1990); Page, M. J. and Sydenham, M. A., Biotechnology 9:64-68 (1991).) Another useful selection marker is the enzyme glutamine synthase (GS) (Murphy et al., Biochem J. 227:277-279 (1991); Bebbington et al., Bio/Technology 10:169-175 (1992). Using these markers, the mammalian cells are grown in selective medium and the cells with the highest resistance are selected. These cell lines contain the amplified gene(s) integrated into a chromosome. Chinese hamster ovary (CHO) and NSO cells are often used for the production of proteins.
- [0932] Derivatives of the plasmid pSV2-dhfr (ATCC Accession No. 37146), the expression vectors pC4 (ATCC Accession No. 209646) and pC6 (ATCC Accession No. 209647) contain the strong promoter (LTR) of the Rous Sarcoma Virus (Cullen et al., Molecular and Cellular Biology, 438-447 (March, 1985)) plus a fragment of the CMV-enhancer (Boshart et al., Cell 41:521-530 (1985).) Multiple cloning sites, e.g., with the restriction enzyme cleavage sites BamHI, XbaI and Asp718, facilitate the cloning of the gene of interest. The vectors also contain the 3' intron, the polyadenylation and termination signal of the rat preproinsulin gene, and the mouse DHFR gene under control of the SV40 early promoter.
- [0933] Specifically, the plasmid pC6, for example, is digested with appropriate restriction enzymes and then dephosphorylated using calf intestinal phosphates by procedures known in the art. The vector is then isolated from a 1% agarose gel.
- [0934] A polynucleotide of the present invention is amplified according to the protocol outlined in Example 1. If a naturally occurring signal sequence is used to produce the polypeptide of the present invention, the vector does not need a second signal peptide. Alternatively, if a naturally occurring signal sequence is not used, the vector can be modified to include a heterologous signal sequence. (See, e.g., International Publication No. WO 96/34891.)
- [0935] The amplified fragment is isolated from a 1% agarose gel using a commercially available kit ("GeneClean," BIO 101 Inc., La Jolla, Ca.). The fragment

then is digested with appropriate restriction enzymes and again purified on a 1% agarose gel.

[0936] The amplified fragment is then digested with the same restriction enzyme and purified on a 1% agarose gel. The isolated fragment and the dephosphorylated vector are then ligated with T4 DNA ligase. *E. coli* HB101 or XL-1 Blue cells are then transformed and bacteria are identified that contain the fragment inserted into plasmid pC6 using, for instance, restriction enzyme analysis.

[0937] Chinese hamster ovary cells lacking an active DHFR gene is used for transfection. Five μ g of the expression plasmid pC6 or pC4 is cotransfected with 0.5 μ g of the plasmid pSVneo using lipofectin (Felgner et al., *supra*). The plasmid pSV2-neo contains a dominant selectable marker, the *neo* gene from Tn5 encoding an enzyme that confers resistance to a group of antibiotics including G418. The cells are seeded in alpha minus MEM supplemented with 1 mg/ml G418. After 2 days, the cells are trypsinized and seeded in hybridoma cloning plates (Greiner, Germany) in alpha minus MEM supplemented with 10, 25, or 50 ng/ml of methotrexate plus 1 mg/ml G418. After about 10-14 days single clones are trypsinized and then seeded in 6-well petri dishes or 10 ml flasks using different concentrations of methotrexate (50 nM, 100 nM, 200 nM, 400 nM, 800 nM). Clones growing at the highest concentrations of methotrexate are then transferred to new 6-well plates containing even higher concentrations of methotrexate (1 μ M, 2 μ M, 5 μ M, 10 mM, 20 mM). The same procedure is repeated until clones are obtained which grow at a concentration of 100 - 200 μ M. Expression of the desired gene product is analyzed, for instance, by SDS-PAGE and Western blot or by reversed phase HPLC analysis.

Example 9: Protein Fusions

[0938] The polypeptides of the present invention are preferably fused to other proteins. These fusion proteins can be used for a variety of applications. For example, fusion of the present polypeptides to His-tag, HA-tag, protein A, IgG domains, and maltose binding protein facilitates purification. (See Example 5; see also EP A 394,827; Traunecker, et al., Nature 331:84-86 (1988).) Similarly, fusion to IgG-1, IgG-3, and albumin increases the half-life time *in vivo*. Nuclear localization signals

fused to the polypeptides of the present invention can target the protein to a specific subcellular localization, while covalent heterodimer or homodimers can increase or decrease the activity of a fusion protein. Fusion proteins can also create chimeric molecules having more than one function. Finally, fusion proteins can increase solubility and/or stability of the fused protein compared to the non-fused protein. All of the types of fusion proteins described above can be made by modifying the following protocol, which outlines the fusion of a polypeptide to an IgG molecule, or the protocol described in Example 5.

[0939] Briefly, the human Fc portion of the IgG molecule can be PCR amplified, using primers that span the 5' and 3' ends of the sequence described below. These primers also should have convenient restriction enzyme sites that will facilitate cloning into an expression vector, preferably a mammalian expression vector.

[0940] For example, if pC4 (ATCC Accession No. 209646) is used, the human Fc portion can be ligated into the BamHI cloning site. Note that the 3' BamHI site should be destroyed. Next, the vector containing the human Fc portion is re-restricted with BamHI, linearizing the vector, and a polynucleotide of the present invention, isolated by the PCR protocol described in Example 1, is ligated into this BamHI site. Note that the polynucleotide is cloned without a stop codon, otherwise a fusion protein will not be produced.

[0941] If the naturally occurring signal sequence is used to produce the polypeptide of the present invention, pC4 does not need a second signal peptide. Alternatively, if the naturally occurring signal sequence is not used, the vector can be modified to include a heterologous signal sequence. (See, e.g., International Publication No. WO 96/34891.)

[0942] Human IgG Fc region:

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GGGATCCGGAGCCCAAATCTTCTGACAAACTCACACATGCCCACCGTGC
CCAGCACCTGAATTCGAGGGTGCACCGTCAGTCTTCCTCTTCCCCCAAAA
CCCAAGGACACCCTCATGATCTCCCGGACTCCTGAGGTCACATGCGTGGTG
GTGGACGTAAGCCACGAAGACCCTGAGGTCAAGTTCAACTGGTACGTGGA
CGGCGTGGAGGTGCATAATGCCAAGACAAAGCCGCGGGAGGAGCAGTAC
AACAGCACGTACCGTGTGGTCAGCGTCCTCACCGTCCTGCACCAGGACTGG
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CTGAATGGCAAGGAGTACAAGTGCAAGGTCTCCAACAAAGCCCTCCCAAC
 CCCCATCGAGAAAACCATCTCCAAAGCCAAAGGGCAGCCCCGAGAACCAC
 AGGTGTACACCCTGCCCCCATCCCGGGATGAGCTGACCAAGAACCAGGTC
 AGCCTGACCTGCCTGGTCAAAGGCTTCTATCCAAGCGACATCGCCGTGGAG
 TGGGAGAGCAATGGGCAGCCGGAGAACAACACTACAAGACCACGCCTCCCGT
 GCTGGACTCCGACGGCTCCTTCTTCTCTACAGCAAGCTCACCGTGGACAA
 GAGCAGGTGGCAGCAGGGGAACGTCTTCTCATGCTCCGTGATGCATGAGG
 CTCTGCACAACCACTACACGCAGAAGAGCCTCTCCCTGTCTCCGGGTAAAT
 GAGTGCGACGGCCGCGACTCTAGAGGAT (SEQ ID NO: 1)

Example 10: Production of an Antibody from a Polypeptide

Hybridoma Technology

[0943] The antibodies of the present invention can be prepared by a variety of methods. (See, Current Protocols, Chapter 2.) As one example of such methods, cells expressing polypeptide of the present invention are administered to an animal to induce the production of sera containing polyclonal antibodies. In a preferred method, a preparation of polypeptide of the present invention is prepared and purified to render it substantially free of natural contaminants. Such a preparation is then introduced into an animal in order to produce polyclonal antisera of greater specific activity.

[0944] Monoclonal antibodies specific for polypeptide of the present invention are prepared using hybridoma technology (Kohler et al., Nature 256:495 (1975); Kohler et al., Eur. J. Immunol. 6:511 (1976); Kohler et al., Eur. J. Immunol. 6:292 (1976); Hammerling et al., in: Monoclonal Antibodies and T-Cell Hybridomas, Elsevier, N.Y., pp. 563-681 (1981)). In general, an animal (preferably a mouse) is immunized with polypeptide of the present invention or, more preferably, with a secreted polypeptide of the present invention-expressing cell. Such polypeptide-expressing cells are cultured in any suitable tissue culture medium, preferably in Earle's modified Eagle's medium supplemented with 10% fetal bovine serum (inactivated at about 56°C), and supplemented with about 10 g/l of nonessential amino acids, about 1,000 U/ml of penicillin, and about 100 µg/ml of streptomycin.

[0945] The splenocytes of such mice are extracted and fused with a suitable myeloma cell line. Any suitable myeloma cell line may be employed in accordance with the present invention; however, it is preferable to employ the parent myeloma cell line (SP2O), available from the ATCC. After fusion, the resulting hybridoma cells are selectively maintained in HAT medium, and then cloned by limiting dilution as described by Wands et al. (Gastroenterology 80:225-232 (1981)). The hybridoma cells obtained through such a selection are then assayed to identify clones which secrete antibodies capable of binding the polypeptide of the present invention.

[0946] Alternatively, additional antibodies capable of binding to polypeptide of the present invention can be produced in a two-step procedure using anti-idiotypic antibodies. Such a method makes use of the fact that antibodies are themselves antigens, and therefore, it is possible to obtain an antibody which binds to a second antibody. In accordance with this method, protein specific antibodies are used to immunize an animal, preferably a mouse. The splenocytes of such an animal are then used to produce hybridoma cells, and the hybridoma cells are screened to identify clones which produce an antibody whose ability to bind to the polypeptide of the present invention-specific antibody can be blocked by polypeptide of the present invention. Such antibodies comprise anti-idiotypic antibodies to the polypeptide of the present invention-specific antibody and are used to immunize an animal to induce formation of further polypeptide of the present invention-specific antibodies.

[0947] For *in vivo* use of antibodies in humans, an antibody is "humanized". Such antibodies can be produced using genetic constructs derived from hybridoma cells producing the monoclonal antibodies described above. Methods for producing chimeric and humanized antibodies are known in the art and are discussed herein. (See, for review, Morrison, Science 229:1202 (1985); Oi et al., BioTechniques 4:214 (1986); Cabilly et al., U.S. Patent No. 4,816,567; Taniguchi et al., EP 171496; Morrison et al., EP 173494; Neuberger et al., WO 8601533; Robinson et al., International Publication No. WO 8702671; Boulianne et al., Nature 312:643 (1984); Neuberger et al., Nature 314:268 (1985).)

*Isolation Of Antibody Fragments Directed Against Polypeptide of the Present Invention
From A Library Of scFvs*

[0948] Naturally occurring V-genes isolated from human PBLs are constructed into a library of antibody fragments which contain reactivities against polypeptide of the present invention to which the donor may or may not have been exposed (see e.g., U.S. Patent 5,885,793 incorporated herein by reference in its entirety).

[0949] *Rescue of the Library.* A library of scFvs is constructed from the RNA of human PBLs as described in International Publication No. WO 92/01047. To rescue phage displaying antibody fragments, approximately 10^9 *E. coli* harboring the phagemid are used to inoculate 50 ml of 2xTY containing 1% glucose and 100 µg/ml of ampicillin (2xTY-AMP-GLU) and grown to an O.D. of 0.8 with shaking. Five ml of this culture is used to inoculate 50 ml of 2xTY-AMP-GLU, 2×10^8 TU of delta gene 3 helper (M13 delta gene III, see International Publication No. WO 92/01047) are added and the culture incubated at 37°C for 45 minutes without shaking and then at 37°C for 45 minutes with shaking. The culture is centrifuged at 4000 r.p.m. for 10 min. and the pellet resuspended in 2 liters of 2xTY containing 100 µg/ml ampicillin and 50 ug/ml kanamycin and grown overnight. Phage are prepared as described in International Application No. WO 92/01047.

[0950] M13 delta gene III is prepared as follows: M13 delta gene III helper phage does not encode gene III protein, hence the phage(mid) displaying antibody fragments have a greater avidity of binding to antigen. Infectious M13 delta gene III particles are made by growing the helper phage in cells harboring a pUC19 derivative supplying the wild type gene III protein during phage morphogenesis. The culture is incubated for 1 hour at 37° C without shaking and then for a further hour at 37°C with shaking. Cells are spun down (IEC-Centra 8,400 r.p.m. for 10 min), resuspended in 300 ml 2xTY broth containing 100 µg ampicillin/ml and 25 µg kanamycin/ml (2xTY-AMP-KAN) and grown overnight, shaking at 37°C. Phage particles are purified and concentrated from the culture medium by two PEG-precipitations (Sambrook et al., 1990), resuspended in 2 ml PBS and passed through a 0.45 µm filter (Minisart NML; Sartorius) to give a final concentration of approximately 10^{13} transducing units/ml (ampicillin-resistant clones).

[0951] *Panning of the Library.* Immunotubes (Nunc) are coated overnight in PBS with 4 ml of either 100 µg/ml or 10 µg/ml of a polypeptide of the present invention. Tubes are blocked with 2% Marvel-PBS for 2 hours at 37°C and then washed 3 times

in PBS. Approximately 10^{13} TU of phage is applied to the tube and incubated for 30 minutes at room temperature tumbling on an over and under turntable and then left to stand for another 1.5 hours. Tubes are washed 10 times with PBS 0.1% Tween-20 and 10 times with PBS. Phage are eluted by adding 1 ml of 100 mM triethylamine and rotating 15 minutes on an under and over turntable after which the solution is immediately neutralized with 0.5 ml of 1.0M Tris-HCl, pH 7.4. Phage are then used to infect 10 ml of mid-log E. coli TG1 by incubating eluted phage with bacteria for 30 minutes at 37°C. The E. coli are then plated on TYE plates containing 1% glucose and 100 µg/ml ampicillin. The resulting bacterial library is then rescued with delta gene 3 helper phage as described above to prepare phage for a subsequent round of selection. This process is then repeated for a total of 4 rounds of affinity purification with tube-washing increased to 20 times with PBS, 0.1% Tween-20 and 20 times with PBS for rounds 3 and 4.

[0952] *Characterization of Binders.* Eluted phage from the 3rd and 4th rounds of selection are used to infect E. coli HB 2151 and soluble scFv is produced (Marks, et al., 1991) from single colonies for assay. ELISAs are performed with microtitre plates coated with 10 pg/ml of the polypeptide of the present invention in 50 mM bicarbonate pH 9.6. Clones positive in ELISA are further characterized by PCR fingerprinting (see, e.g., International Application No. WO 92/01047) and then by sequencing. These ELISA positive clones may also be further characterized by techniques known in the art, such as, for example, epitope mapping, binding affinity, receptor signal transduction, ability to block or competitively inhibit antibody/antigen binding, and competitive agonistic or antagonistic activity.

Example 11: Method of Determining Alterations in a Gene Corresponding to a Polynucleotide

[0953] RNA isolated from entire families or individual patients presenting with a phenotype of interest (such as a disease) is isolated. cDNA is then generated from these RNA samples using protocols known in the art. (See, Sambrook.) The cDNA is then used as a template for PCR, employing primers surrounding regions of interest in

SEQ ID NO:X; and/or the nucleotide sequence of the cDNA contained in Clone ID NO:Z. Suggested PCR conditions consist of 35 cycles at 95 degrees C for 30 seconds; 60-120 seconds at 52-58 degrees C; and 60-120 seconds at 70 degrees C, using buffer solutions described in Sidransky et al., Science 252:706 (1991).

[0954] PCR products are then sequenced using primers labeled at their 5' end with T4 polynucleotide kinase; employing SequiTherm Polymerase (Epicentre Technologies). The intron-exon boundaries of selected exons is also determined and genomic PCR products analyzed to confirm the results. PCR products harboring suspected mutations are then cloned and sequenced to validate the results of the direct sequencing.

[0955] PCR products are cloned into T-tailed vectors as described in Holton et al., Nucleic Acids Research, 19:1156 (1991) and sequenced with T7 polymerase (United States Biochemical). Affected individuals are identified by mutations not present in unaffected individuals.

[0956] Genomic rearrangements are also observed as a method of determining alterations in a gene corresponding to a polynucleotide. Genomic clones isolated according to Example 2 are nick-translated with digoxigenindeoxy-uridine 5'-triphosphate (Boehringer Mannheim), and FISH performed as described in Johnson et al., Methods Cell Biol. 35:73-99 (1991). Hybridization with the labeled probe is carried out using a vast excess of human cot-1 DNA for specific hybridization to the corresponding genomic locus.

[0957] Chromosomes are counterstained with 4,6-diamino-2-phenylidole and propidium iodide, producing a combination of C- and R-bands. Aligned images for precise mapping are obtained using a triple-band filter set (Chroma Technology, Brattleboro, VT) in combination with a cooled charge-coupled device camera (Photometrics, Tucson, AZ) and variable excitation wavelength filters. (Johnson et al., Genet. Anal. Tech. Appl., 8:75 (1991).) Image collection, analysis and chromosomal fractional length measurements are performed using the ISee Graphical Program System. (Inovision Corporation, Durham, NC.) Chromosome alterations of the genomic region hybridized by the probe are identified as insertions, deletions, and translocations. These alterations are used as a diagnostic marker for an associated disease.

Example 12: Method of Detecting Abnormal Levels of a Polypeptide in a Biological Sample

[0958] A polypeptide of the present invention can be detected in a biological sample, and if an increased or decreased level of the polypeptide is detected, this polypeptide is a marker for a particular phenotype. Methods of detection are numerous, and thus, it is understood that one skilled in the art can modify the following assay to fit their particular needs.

[0959] For example, antibody-sandwich ELISAs are used to detect polypeptides in a sample, preferably a biological sample. Wells of a microtiter plate are coated with specific antibodies, at a final concentration of 0.2 to 10 ug/ml. The antibodies are either monoclonal or polyclonal and are produced by the method described in Example 10. The wells are blocked so that non-specific binding of the polypeptide to the well is reduced.

[0960] The coated wells are then incubated for > 2 hours at RT with a sample containing the polypeptide. Preferably, serial dilutions of the sample should be used to validate results. The plates are then washed three times with deionized or distilled water to remove unbound polypeptide.

[0961] Next, 50 ul of specific antibody-alkaline phosphatase conjugate, at a concentration of 25-400 ng, is added and incubated for 2 hours at room temperature. The plates are again washed three times with deionized or distilled water to remove unbound conjugate.

[0962] Add 75 ul of 4-methylumbelliferyl phosphate (MUP) or p-nitrophenyl phosphate (NPP) substrate solution to each well and incubate 1 hour at room temperature. Measure the reaction by a microtiter plate reader. Prepare a standard curve, using serial dilutions of a control sample, and plot polypeptide concentration on the X-axis (log scale) and fluorescence or absorbance of the Y-axis (linear scale). Interpolate the concentration of the polypeptide in the sample using the standard curve.

Example 13: Formulation

[0963] The invention also provides methods of treatment and/or prevention of diseases or disorders (such as, for example, any one or more of the diseases or disorders disclosed herein) by administration to a subject of an effective amount of a Therapeutic. By "Therapeutic" is meant polynucleotides or polypeptides of the invention (including fragments, analogs, derivatives and variants thereof), agonists or antagonists thereof, and/or antibodies thereto (including fragments thereof), in combination with a pharmaceutically acceptable carrier type (e.g., a sterile carrier).

[0964] The Therapeutic will be formulated and dosed in a fashion consistent with good medical practice, taking into account the clinical condition of the individual patient (especially the side effects of treatment with the Therapeutic alone), the site of delivery, the method of administration, the scheduling of administration, and other factors known to practitioners. The "effective amount" for purposes herein is thus determined by such considerations.

[0965] As a general proposition, the total pharmaceutically effective amount of the Therapeutic administered parenterally per dose will be in the range of about 1 ug/kg/day to 10 mg/kg/day of patient body weight, although, as noted above, this will be subject to therapeutic discretion. More preferably, this dose is at least 0.01 mg/kg/day, and most preferably for humans between about 0.01 and 1 mg/kg/day for the hormone. If given continuously, the Therapeutic is typically administered at a dose rate of about 1 ug/kg/hour to about 50 ug/kg/hour, either by 1-4 injections per day or by continuous subcutaneous infusions, for example, using a mini-pump. An intravenous bag solution may also be employed. The length of treatment needed to observe changes and the interval following treatment for responses to occur appears to vary depending on the desired effect.

[0966] Therapeutics can be administered orally, rectally, parenterally, intracisternally, intravaginally, intraperitoneally, topically (as by powders, ointments, gels, drops or transdermal patch), buccally, or as an oral or nasal spray. "Pharmaceutically acceptable carrier" refers to a non-toxic solid, semisolid or liquid filler, diluent, encapsulating material or formulation auxiliary of any. The term "parenteral" as used herein refers to modes of administration which include

intravenous, intramuscular, intraperitoneal, intrasternal, subcutaneous and intraarticular injection and infusion.

[0967] Therapeutics of the invention are also suitably administered by sustained-release systems. Suitable examples of sustained-release Therapeutics are administered orally, rectally, parenterally, intracisternally, intravaginally, intraperitoneally, topically (as by powders, ointments, gels, drops or transdermal patch), buccally, or as an oral or nasal spray. "Pharmaceutically acceptable carrier" refers to a non-toxic solid, semisolid or liquid filler, diluent, encapsulating material or formulation auxiliary of any type. The term "parenteral" as used herein refers to modes of administration which include intravenous, intramuscular, intraperitoneal, intrasternal, subcutaneous and intraarticular injection and infusion.

[0968] Therapeutics of the invention are also suitably administered by sustained-release systems. Suitable examples of sustained-release Therapeutics include suitable polymeric materials (such as, for example, semi-permeable polymer matrices in the form of shaped articles, e.g., films, or microcapsules), suitable hydrophobic materials (for example as an emulsion in an acceptable oil) or ion exchange resins, and sparingly soluble derivatives (such as, for example, a sparingly soluble salt).

[0969] Sustained-release matrices include polylactides (U.S. Pat. No. 3,773,919, EP 58,481), copolymers of L-glutamic acid and gamma-ethyl-L-glutamate (Sidman et al., *Biopolymers* 22:547-556 (1983)), poly (2-hydroxyethyl methacrylate) (Langer et al., *J. Biomed. Mater. Res.* 15:167-277 (1981), and Langer, *Chem. Tech.* 12:98-105 (1982)), ethylene vinyl acetate (Langer et al., *Id.*) or poly-D-(-)-3-hydroxybutyric acid (EP 133,988).

[0970] Sustained-release Therapeutics also include liposomally entrapped Therapeutics of the invention (*see generally*, Langer, *Science* 249:1527-1533 (1990); Treat et al., in *Liposomes in the Therapy of Infectious Disease and Cancer*, Lopez-Berestein and Fidler (eds.), Liss, New York, pp. 317-327 and 353-365 (1989)). Liposomes containing the Therapeutic are prepared by methods known per se: DE 3,218,121; Epstein et al., *Proc. Natl. Acad. Sci. (USA)* 82:3688-3692 (1985); Hwang et al., *Proc. Natl. Acad. Sci. (USA)* 77:4030-4034 (1980); EP 52,322; EP 36,676; EP 88,046; EP 143,949; EP 142,641; Japanese Pat. Appl. 83-118008; U.S. Pat. Nos. 4,485,045 and 4,544,545; and EP 102,324. Ordinarily, the liposomes are of the small

(about 200-800 Angstroms) unilamellar type in which the lipid content is greater than about 30 mol. percent cholesterol, the selected proportion being adjusted for the optimal Therapeutic.

[0971] In yet an additional embodiment, the Therapeutics of the invention are delivered by way of a pump (*see* Langer, *supra*; Sefton, CRC Crit. Ref. Biomed. Eng. 14:201 (1987); Buchwald et al., Surgery 88:507 (1980); Saudek et al., N. Engl. J. Med. 321:574 (1989)).

[0972] Other controlled release systems are discussed in the review by Langer (*Science* 249:1527-1533 (1990)).

[0973] For parenteral administration, in one embodiment, the Therapeutic is formulated generally by mixing it at the desired degree of purity, in a unit dosage injectable form (solution, suspension, or emulsion), with a pharmaceutically acceptable carrier, i.e., one that is non-toxic to recipients at the dosages and concentrations employed and is compatible with other ingredients of the formulation. For example, the formulation preferably does not include oxidizing agents and other compounds that are known to be deleterious to the Therapeutic.

[0974] Generally, the formulations are prepared by contacting the Therapeutic uniformly and intimately with liquid carriers or finely divided solid carriers or both. Then, if necessary, the product is shaped into the desired formulation. Preferably the carrier is a parenteral carrier, more preferably a solution that is isotonic with the blood of the recipient. Examples of such carrier vehicles include water, saline, Ringer's solution, and dextrose solution. Non-aqueous vehicles such as fixed oils and ethyl oleate are also useful herein, as well as liposomes.

[0975] The carrier suitably contains minor amounts of additives such as substances that enhance isotonicity and chemical stability. Such materials are non-toxic to recipients at the dosages and concentrations employed, and include buffers such as phosphate, citrate, succinate, acetic acid, and other organic acids or their salts; antioxidants such as ascorbic acid; low molecular weight (less than about ten residues) polypeptides, e.g., polyarginine or tripeptides; proteins, such as serum albumin, gelatin, or immunoglobulins; hydrophilic polymers such as polyvinylpyrrolidone; amino acids, such as glycine, glutamic acid, aspartic acid, or arginine; monosaccharides, disaccharides, and other carbohydrates including cellulose or its

derivatives, glucose, manose, or dextrans; chelating agents such as EDTA; sugar alcohols such as mannitol or sorbitol; counterions such as sodium; and/or nonionic surfactants such as polysorbates, poloxamers, or PEG.

[0976] The Therapeutic is typically formulated in such vehicles at a concentration of about 0.1 mg/ml to 100 mg/ml, preferably 1-10 mg/ml, at a pH of about 3 to 8. It will be understood that the use of certain of the foregoing excipients, carriers, or stabilizers will result in the formation of polypeptide salts.

[0977] Any pharmaceutical used for therapeutic administration can be sterile. Sterility is readily accomplished by filtration through sterile filtration membranes (e.g., 0.2 micron membranes). Therapeutics generally are placed into a container having a sterile access port, for example, an intravenous solution bag or vial having a stopper pierceable by a hypodermic injection needle.

[0978] Therapeutics ordinarily will be stored in unit or multi-dose containers, for example, sealed ampoules or vials, as an aqueous solution or as a lyophilized formulation for reconstitution. As an example of a lyophilized formulation, 10-ml vials are filled with 5 ml of sterile-filtered 1% (w/v) aqueous Therapeutic solution, and the resulting mixture is lyophilized. The infusion solution is prepared by reconstituting the lyophilized Therapeutic using bacteriostatic Water-for-Injection.

[0979] The invention also provides a pharmaceutical pack or kit comprising one or more containers filled with one or more of the ingredients of the Therapeutics of the invention. Associated with such container(s) can be a notice in the form prescribed by a governmental agency regulating the manufacture, use or sale of pharmaceuticals or biological products, which notice reflects approval by the agency of manufacture, use or sale for human administration. In addition, the Therapeutics may be employed in conjunction with other therapeutic compounds.

[0980] The Therapeutics of the invention may be administered alone or in combination with adjuvants. Adjuvants that may be administered with the Therapeutics of the invention include, but are not limited to, alum, alum plus deoxycholate (ImmunoAg), MTP-PE (Biocine Corp.), QS21 (Genentech, Inc.), BCG, and MPL. In a specific embodiment, Therapeutics of the invention are administered in combination with alum. In another specific embodiment, Therapeutics of the invention are administered in combination with QS-21. Further adjuvants that may be

administered with the Therapeutics of the invention include, but are not limited to, Monophosphoryl lipid immunomodulator, AdjuVax 100a, QS-21, QS-18, CRL1005, Aluminum salts, MF-59, and Viroosomal adjuvant technology. Vaccines that may be administered with the Therapeutics of the invention include, but are not limited to, vaccines directed toward protection against MMR (measles, mumps, rubella), polio, varicella, tetanus/diphtheria, hepatitis A, hepatitis B, haemophilus influenzae B, whooping cough, pneumonia, influenza, Lyme's Disease, rotavirus, cholera, yellow fever, Japanese encephalitis, poliomyelitis, rabies, typhoid fever, and pertussis. Combinations may be administered either concomitantly, e.g., as an admixture, separately but simultaneously or concurrently; or sequentially. This includes presentations in which the combined agents are administered together as a therapeutic mixture, and also procedures in which the combined agents are administered separately but simultaneously, e.g., as through separate intravenous lines into the same individual. Administration "in combination" further includes the separate administration of one of the compounds or agents given first, followed by the second.

[0981] The Therapeutics of the invention may be administered alone or in combination with other therapeutic agents. Therapeutic agents that may be administered in combination with the Therapeutics of the invention, include but not limited to, other members of the TNF family, chemotherapeutic agents, antibiotics, steroidal and non-steroidal anti-inflammatories, conventional immunotherapeutic agents, cytokines and/or growth factors. Combinations may be administered either concomitantly, e.g., as an admixture, separately but simultaneously or concurrently; or sequentially. This includes presentations in which the combined agents are administered together as a therapeutic mixture, and also procedures in which the combined agents are administered separately but simultaneously, e.g., as through separate intravenous lines into the same individual. Administration "in combination" further includes the separate administration of one of the compounds or agents given first, followed by the second.

[0982] In one embodiment, the Therapeutics of the invention are administered in combination with members of the TNF family. TNF, TNF-related or TNF-like molecules that may be administered with the Therapeutics of the invention include, but are not limited to, soluble forms of TNF-alpha, lymphotoxin-alpha (LT-alpha, also

known as TNF-beta), LT-beta (found in complex heterotrimer LT-alpha2-beta), OPGL, FasL, CD27L, CD30L, CD40L, 4-1BBL, DcR3, OX40L, TNF-gamma (International Publication No. WO 96/14328), AIM-I (International Publication No. WO 97/33899), endokine-alpha (International Publication No. WO 98/07880), TR6 (International Publication No. WO 98/30694), OPG, and neutrokin-alpha (International Publication No. WO 98/18921, OX40, and nerve growth factor (NGF), and soluble forms of Fas, CD30, CD27, CD40 and 4-1BB, TR2 (International Publication No. WO 96/34095), DR3 (International Publication No. WO 97/33904), DR4 (International Publication No. WO 98/32856), TR5 (International Publication No. WO 98/30693), TR6 (International Publication No. WO 98/30694), TR7 (International Publication No. WO 98/41629), TRANK, TR9 (International Publication No. WO 98/56892), TR10 (International Publication No. WO 98/54202), 312C2 (International Publication No. WO 98/06842), and TR12, and soluble forms CD154, CD70, and CD153.

[0983] In certain embodiments, Therapeutics of the invention are administered in combination with antiretroviral agents, nucleoside reverse transcriptase inhibitors, non-nucleoside reverse transcriptase inhibitors, and/or protease inhibitors. Nucleoside reverse transcriptase inhibitors that may be administered in combination with the Therapeutics of the invention, include, but are not limited to, RETROVIR™ (zidovudine/AZT), VIDEX™ (didanosine/ddI), HIVID™ (zalcitabine/ddC), ZERIT™ (stavudine/d4T), EPIVIR™ (lamivudine/3TC), and COMBIVIR™ (zidovudine/lamivudine). Non-nucleoside reverse transcriptase inhibitors that may be administered in combination with the Therapeutics of the invention, include, but are not limited to, VIRAMUNE™ (nevirapine), RESCRIPTOR™ (delavirdine), and SUSTIVA™ (efavirenz). Protease inhibitors that may be administered in combination with the Therapeutics of the invention, include, but are not limited to, CRIVAN™ (indinavir), NORVIR™ (ritonavir), INVIRASE™ (saquinavir), and VIRACEPT™ (nelfinavir). In a specific embodiment, antiretroviral agents, nucleoside reverse transcriptase inhibitors, non-nucleoside reverse transcriptase inhibitors, and/or protease inhibitors may be used in any combination with Therapeutics of the invention to treat AIDS and/or to prevent or treat HIV infection.

[0984] In other embodiments, Therapeutics of the invention may be administered in combination with anti-opportunistic infection agents. Anti-opportunistic agents that may be administered in combination with the Therapeutics of the invention, include, but are not limited to, TRIMETHOPRIM-SULFAMETHOXAZOLE™, DAPSONE™, PENTAMIDINE™, ATOVAQUONE™, ISONIAZID™, RIFAMPIN™, PYRAZINAMIDE™, ETHAMBUTOL™, RIFABUTIN™, CLARITHROMYCIN™, AZITHROMYCIN™, GANCICLOVIR™, FOSCARNET™, CIDOFOVIR™, FLUCONAZOLE™, ITRACONAZOLE™, KETOCONAZOLE™, ACYCLOVIR™, FAMCICOLVIR™, PYRIMETHAMINE™, LEUCOVORIN™, NEUPOGEN™ (filgrastim/G-CSF), and LEUKINE™ (sargramostim/GM-CSF). In a specific embodiment, Therapeutics of the invention are used in any combination with TRIMETHOPRIM-SULFAMETHOXAZOLE™, DAPSONE™, PENTAMIDINE™, and/or ATOVAQUONE™ to prophylactically treat or prevent an opportunistic *Pneumocystis carinii* pneumonia infection. In another specific embodiment, Therapeutics of the invention are used in any combination with ISONIAZID™, RIFAMPIN™, PYRAZINAMIDE™, and/or ETHAMBUTOL™ to prophylactically treat or prevent an opportunistic *Mycobacterium avium* complex infection. In another specific embodiment, Therapeutics of the invention are used in any combination with RIFABUTIN™, CLARITHROMYCIN™, and/or AZITHROMYCIN™ to prophylactically treat or prevent an opportunistic *Mycobacterium tuberculosis* infection. In another specific embodiment, Therapeutics of the invention are used in any combination with GANCICLOVIR™, FOSCARNET™, and/or CIDOFOVIR™ to prophylactically treat or prevent an opportunistic cytomegalovirus infection. In another specific embodiment, Therapeutics of the invention are used in any combination with FLUCONAZOLE™, ITRACONAZOLE™, and/or KETOCONAZOLE™ to prophylactically treat or prevent an opportunistic fungal infection. In another specific embodiment, Therapeutics of the invention are used in any combination with ACYCLOVIR™ and/or FAMCICOLVIR™ to prophylactically treat or prevent an opportunistic herpes simplex virus type I and/or type II infection. In another specific embodiment, Therapeutics of the invention are used in any combination with

PYRIMETHAMINE™ and/or LEUCOVORIN™ to prophylactically treat or prevent an opportunistic *Toxoplasma gondii* infection. In another specific embodiment, Therapeutics of the invention are used in any combination with LEUCOVORIN™ and/or NEUPOGEN™ to prophylactically treat or prevent an opportunistic bacterial infection.

[0985] In a further embodiment, the Therapeutics of the invention are administered in combination with an antiviral agent. Antiviral agents that may be administered with the Therapeutics of the invention include, but are not limited to, acyclovir, ribavirin, amantadine, and remantidine.

[0986] In a further embodiment, the Therapeutics of the invention are administered in combination with an antibiotic agent. Antibiotic agents that may be administered with the Therapeutics of the invention include, but are not limited to, amoxicillin, beta-lactamases, aminoglycosides, beta-lactam (glycopeptide), beta-lactamases, Clindamycin, chloramphenicol, cephalosporins, ciprofloxacin, ciprofloxacin, erythromycin, fluoroquinolones, macrolides, metronidazole, penicillins, quinolones, rifampin, streptomycin, sulfonamide, tetracyclines, trimethoprim, trimethoprim-sulfamthoxazole, and vancomycin.

[0987] Conventional nonspecific immunosuppressive agents, that may be administered in combination with the Therapeutics of the invention include, but are not limited to, steroids, cyclosporine, cyclosporine analogs, cyclophosphamide methylprednisone, prednisone, azathioprine, FK-506, 15-deoxyspergualin, and other immunosuppressive agents that act by suppressing the function of responding T cells.

[0988] In specific embodiments, Therapeutics of the invention are administered in combination with immunosuppressants. Immunosuppressants preparations that may be administered with the Therapeutics of the invention include, but are not limited to, ORTHOCLONE™ (OKT3), SANDIMMUNE™/NEORAL™/SANGDYA™ (cyclosporin), PROGRAF™ (tacrolimus), CELLCEPT™ (mycophenolate), Azathioprine, glucocorticosteroids, and RAPAMUNE™ (sirolimus). In a specific embodiment, immunosuppressants may be used to prevent rejection of organ or bone marrow transplantation.

[0989] In an additional embodiment, Therapeutics of the invention are administered alone or in combination with one or more intravenous immune globulin preparations. Intravenous immune globulin preparations that may be administered with the Therapeutics of the invention include, but not limited to, GAMMAR™, IVEEGAM™, SANDOGLOBULIN™, GAMMAGARD S/D™, and GAMIMUNE™. In a specific embodiment, Therapeutics of the invention are administered in combination with intravenous immune globulin preparations in transplantation therapy (e.g., bone marrow transplant).

[0990] In an additional embodiment, the Therapeutics of the invention are administered alone or in combination with an anti-inflammatory agent. Anti-inflammatory agents that may be administered with the Therapeutics of the invention include, but are not limited to, glucocorticoids and the nonsteroidal anti-inflammatories, aminoarylcarboxylic acid derivatives, arylacetic acid derivatives, arylbutyric acid derivatives, arylcarboxylic acids, arylpropionic acid derivatives, pyrazoles, pyrazolones, salicylic acid derivatives, thiazinecarboxamides, e-acetamidocaproic acid, S-adenosylmethionine, 3-amino-4-hydroxybutyric acid, amixetrine, bendazac, benzydamine, bucolome, difenpiramide, ditazol, emorfazone, guaiazulene, nabumetone, nimesulide, orgotein, oxaceprol, paranyline, perisoxal, pifoxime, proquazone, proxazole, and tenidap.

[0991] In an additional embodiment, the compositions of the invention are administered alone or in combination with an anti-angiogenic agent. Anti-angiogenic agents that may be administered with the compositions of the invention include, but are not limited to, Angiostatin (Entremed, Rockville, MD), Troponin-1 (Boston Life Sciences, Boston, MA), anti-Invasive Factor, retinoic acid and derivatives thereof, paclitaxel (Taxol), Suramin, Tissue Inhibitor of Metalloproteinase-1, Tissue Inhibitor of Metalloproteinase-2, VEGI, Plasminogen Activator Inhibitor-1, Plasminogen Activator Inhibitor-2, and various forms of the lighter "d group" transition metals.

[0992] Lighter "d group" transition metals include, for example, vanadium, molybdenum, tungsten, titanium, niobium, and tantalum species. Such transition metal species may form transition metal complexes. Suitable complexes of the above-mentioned transition metal species include oxo transition metal complexes.

[0993] Representative examples of vanadium complexes include oxo vanadium complexes such as vanadate and vanadyl complexes. Suitable vanadate complexes include metavanadate and orthovanadate complexes such as, for example, ammonium metavanadate, sodium metavanadate, and sodium orthovanadate. Suitable vanadyl complexes include, for example, vanadyl acetylacetonate and vanadyl sulfate including vanadyl sulfate hydrates such as vanadyl sulfate mono- and trihydrates.

[0994] Representative examples of tungsten and molybdenum complexes, also include oxo complexes. Suitable oxo tungsten complexes include tungstate and tungsten oxide complexes. Suitable tungstate complexes include ammonium tungstate, calcium tungstate, sodium tungstate dihydrate, and tungstic acid. Suitable tungsten oxides include tungsten (IV) oxide and tungsten (VI) oxide. Suitable oxo molybdenum complexes include molybdate, molybdenum oxide, and molybdenyl complexes. Suitable molybdate complexes include ammonium molybdate and its hydrates, sodium molybdate and its hydrates, and potassium molybdate and its hydrates. Suitable molybdenum oxides include molybdenum (VI) oxide, molybdenum (VI) oxide, and molybdic acid. Suitable molybdenyl complexes include, for example, molybdenyl acetylacetonate. Other suitable tungsten and molybdenum complexes include hydroxo derivatives derived from, for example, glycerol, tartaric acid, and sugars.

[0995] A wide variety of other anti-angiogenic factors may also be utilized within the context of the present invention. Representative examples include, but are not limited to, platelet factor 4; protamine sulphate; sulphated chitin derivatives (prepared from queen crab shells), (Murata et al., Cancer Res. 51:22-26 (1991)); Sulphated Polysaccharide Peptidoglycan Complex (SP- PG) (the function of this compound may be enhanced by the presence of steroids such as estrogen, and tamoxifen citrate); Staurosporine; modulators of matrix metabolism, including for example, proline analogs, cishydroxyproline, d,L-3,4-dehydroproline, Thiaproline, alpha,alpha-dipyridyl, aminopropionitrile fumarate; 4-propyl-5-(4-pyridinyl)-2(3H)-oxazolone; Methotrexate; Mitoxantrone; Heparin; Interferons; 2 Macroglobulin-serum; ChIMP-3 (Pavloff et al., J. Bio. Chem. 267:17321-17326, (1992)); Chymostatin (Tomkinson et al., Biochem J. 286:475-480 (1992)); Cyclodextrin Tetradecasulfate; Eponemycin; Camptothecin; Fumagillin (Ingber et al., Nature 348:555-557, 1990); Gold Sodium

Thiomalate ("GST"; Matsubara and Ziff, *J. Clin. Invest.* 79:1440-1446, 1987); anticollagenase-serum; alpha2-antiplasmin (Holmes et al., *J. Biol. Chem.* 262(4):1659-1664 (1987)); Bisantrene (National Cancer Institute); Lobenzarit disodium (N-(2)-carboxyphenyl-4- chloroanthronilic acid disodium or "CCA"; (Takeuchi et al., *Agents Actions* 36:312-316, 1992); and metalloproteinase inhibitors such as BB94.

[0996] Additional anti-angiogenic factors that may also be utilized within the context of the present invention include Thalidomide, (Celgene, Warren, NJ); Angiostatic steroid; AGM-1470 (H. Brem and J. Folkman *J. Pediatr. Surg.* 28:445-51 (1993)); an integrin alpha v beta 3 antagonist (C. Storgard et al., *J. Clin. Invest.* 103:47-54 (1999)); carboxynaminolimidazole; Carboxyamidotriazole (CAI) (National Cancer Institute, Bethesda, MD); Conbretastatin A-4 (CA4P) (OXiGENE, Boston, MA); Squalamine (Magainin Pharmaceuticals, Plymouth Meeting, PA); TNP-470, (Tap Pharmaceuticals, Deerfield, IL); ZD-0101 AstraZeneca (London, UK); APRA (CT2584); Benefin, Byrostatin-1 (SC339555); CGP-41251 (PKC 412); CM101; Dexrazoxane (ICRF187); DMXAA; Endostatin; Flavopridiol; Genestein; GTE; ImmTher; Iressa (ZD1839); Octreotide (Somatostatin); Panretin; Penacillamine; Photopoint; PI-88; Prinomastat (AG-3340) Purlytin; Suradista (FCE26644); Tamoxifen (Nolvadex); Tazartene; Tetrathiomolybdate; Xeloda (Capecitabine); and 5-Fluorouracil.

[0997] Anti-angiogenic agents that may be administered in combination with the compounds of the invention may work through a variety of mechanisms including, but not limited to, inhibiting proteolysis of the extracellular matrix, blocking the function of endothelial cell-extracellular matrix adhesion molecules, by antagonizing the function of angiogenesis inducers such as growth factors, and inhibiting integrin receptors expressed on proliferating endothelial cells. Examples of anti-angiogenic inhibitors that interfere with extracellular matrix proteolysis and which may be administered in combination with the compositions of the invention include, but are not limited to, AG-3340 (Agouron, La Jolla, CA), BAY-12-9566 (Bayer, West Haven, CT), BMS-275291 (Bristol Myers Squibb, Princeton, NJ), CGS-27032A (Novartis, East Hanover, NJ), Marimastat (British Biotech, Oxford, UK), and Metastat (Aeterna, St-Foy, Quebec). Examples of anti-angiogenic inhibitors that act by blocking the function of endothelial cell-extracellular matrix adhesion molecules and which may be

administered in combination with the compositions of the invention include, but are not limited to, EMD-121974 (Merck KgaA Darmstadt, Germany) and Vitaxin (Ixsys, La Jolla, CA/Medimmune, Gaithersburg, MD). Examples of anti-angiogenic agents that act by directly antagonizing or inhibiting angiogenesis inducers and which may be administered in combination with the compositions of the invention include, but are not limited to, Angiozyme (Ribozyme, Boulder, CO), Anti-VEGF antibody (Genentech, S. San Francisco, CA), PTK-787/ZK-225846 (Novartis, Basel, Switzerland), SU-101 (Sugen, S. San Francisco, CA), SU-5416 (Sugen/ Pharmacia Upjohn, Bridgewater, NJ), and SU-6668 (Sugen). Other anti-angiogenic agents act to indirectly inhibit angiogenesis. Examples of indirect inhibitors of angiogenesis which may be administered in combination with the compositions of the invention include, but are not limited to, IM-862 (Cytran, Kirkland, WA), Interferon-alpha, IL-12 (Roche, Nutley, NJ), and Pentosan polysulfate (Georgetown University, Washington, DC).

[0998] In particular embodiments, the use of compositions of the invention in combination with anti-angiogenic agents is contemplated for the treatment, prevention, and/or amelioration of an autoimmune disease, such as for example, an autoimmune disease described herein.

[0999] In a particular embodiment, the use of compositions of the invention in combination with anti-angiogenic agents is contemplated for the treatment, prevention, and/or amelioration of arthritis. In a more particular embodiment, the use of compositions of the invention in combination with anti-angiogenic agents is contemplated for the treatment, prevention, and/or amelioration of rheumatoid arthritis.

[01000] In another embodiment, the polynucleotides encoding a polypeptide of the present invention are administered in combination with an angiogenic protein, or polynucleotides encoding an angiogenic protein. Examples of angiogenic proteins that may be administered with the compositions of the invention include, but are not limited to, acidic and basic fibroblast growth factors, VEGF-1, VEGF-2, VEGF-3, epidermal growth factor alpha and beta, platelet-derived endothelial cell growth factor, platelet-derived growth factor, tumor necrosis factor alpha, hepatocyte growth factor, insulin like growth factor, colony stimulating factor, macrophage colony stimulating factor, granulocyte/macrophage colony stimulating factor, and nitric oxide synthase.

- [01001] In another embodiment, compositions of the invention are administered in combination with a chemotherapeutic agent. Chemotherapeutic agents that may be administered with the compositions of the invention include, but are not limited to, antibiotic derivatives (e.g., doxorubicin, bleomycin, daunorubicin, and dactinomycin); antiestrogens (e.g., tamoxifen); antimetabolites (e.g., fluorouracil, 5-FU, methotrexate, floxuridine, interferon alpha-2b, glutamic acid, plicamycin, mercaptopurine, and 6-thioguanine); cytotoxic agents (e.g., carmustine, BCNU, lomustine, CCNU, cytosine arabinoside, cyclophosphamide, estramustine, hydroxyurea, procarbazine, mitomycin, busulfan, cis-platin, and vincristine sulfate); hormones (e.g., medroxyprogesterone, estramustine phosphate sodium, ethinyl estradiol, estradiol, megestrol acetate, methyltestosterone, diethylstilbestrol diphosphate, chlorotrianisene, and testolactone); nitrogen mustard derivatives (e.g., mephallen, chorambucil, mechlorethamine (nitrogen mustard) and thiotepa); steroids and combinations (e.g., bethamethasone sodium phosphate); and others (e.g., dicarbazine, asparaginase, mitotane, vincristine sulfate, vinblastine sulfate, and etoposide).
- [01002] In a specific embodiment, Therapeutics of the invention are administered in combination with CHOP (cyclophosphamide, doxorubicin, vincristine, and prednisone) or any combination of the components of CHOP. In another embodiment, Therapeutics of the invention are administered in combination with Rituximab. In a further embodiment, Therapeutics of the invention are administered with Rituxmab and CHOP, or Rituxmab and any combination of the components of CHOP.
- [01003] In an additional embodiment, the Therapeutics of the invention are administered in combination with cytokines. Cytokines that may be administered with the Therapeutics of the invention include, but are not limited to, IL2, IL3, IL4, IL5, IL6, IL7, IL10, IL12, IL13, IL15, anti-CD40, CD40L, IFN-gamma and TNF-alpha. In another embodiment, Therapeutics of the invention may be administered with any interleukin, including, but not limited to, IL-1alpha, IL-1beta, IL-2, IL-3, IL-4, IL-5, IL-6, IL-7, IL-8, IL-9, IL-10, IL-11, IL-12, IL-13, IL-14, IL-15, IL-16, IL-17, IL-18, IL-19, IL-20, and IL-21.
- [01004] In an additional embodiment, the Therapeutics of the invention are administered in combination with angiogenic proteins. Angiogenic proteins that may

be administered with the Therapeutics of the invention include, but are not limited to, Glioma Derived Growth Factor (GDGF), as disclosed in European Patent Number EP-399816; Platelet Derived Growth Factor-A (PDGF-A), as disclosed in European Patent Number EP-682110; Platelet Derived Growth Factor-B (PDGF-B), as disclosed in European Patent Number EP-282317; Placental Growth Factor (PIGF), as disclosed in International Publication Number WO 92/06194; Placental Growth Factor-2 (PIGF-2), as disclosed in Hauser et al., Growth Factors, 4:259-268 (1993); Vascular Endothelial Growth Factor (VEGF), as disclosed in International Publication Number WO 90/13649; Vascular Endothelial Growth Factor-A (VEGF-A), as disclosed in European Patent Number EP-506477; Vascular Endothelial Growth Factor-2 (VEGF-2), as disclosed in International Publication Number WO 96/39515; Vascular Endothelial Growth Factor B (VEGF-3); Vascular Endothelial Growth Factor B-186 (VEGF-B186), as disclosed in International Publication Number WO 96/26736; Vascular Endothelial Growth Factor-D (VEGF-D), as disclosed in International Publication Number WO 98/02543; Vascular Endothelial Growth Factor-D (VEGF-D), as disclosed in International Publication Number WO 98/07832; and Vascular Endothelial Growth Factor-E (VEGF-E), as disclosed in German Patent Number DE19639601. The above mentioned references are herein incorporated by reference in their entireties.

[01005] In an additional embodiment, the Therapeutics of the invention are administered in combination with hematopoietic growth factors. Hematopoietic growth factors that may be administered with the Therapeutics of the invention include, but are not limited to, LEUKINE™ (SARGRAMOSTIM™) and NEUPOGEN™ (FILGRASTIM™).

[01006] In an additional embodiment, the Therapeutics of the invention are administered in combination with Fibroblast Growth Factors. Fibroblast Growth Factors that may be administered with the Therapeutics of the invention include, but are not limited to, FGF-1, FGF-2, FGF-3, FGF-4, FGF-5, FGF-6, FGF-7, FGF-8, FGF-9, FGF-10, FGF-11, FGF-12, FGF-13, FGF-14, and FGF-15.

[01007] In additional embodiments, the Therapeutics of the invention are administered in combination with other therapeutic or prophylactic regimens, such as, for example, radiation therapy.

Example 14: Method of Treating Decreased Levels of the Polypeptide

[01008] The present invention relates to a method for treating an individual in need of an increased level of a polypeptide of the invention in the body comprising administering to such an individual a composition comprising a therapeutically effective amount of an agonist of the invention (including polypeptides of the invention). Moreover, it will be appreciated that conditions caused by a decrease in the standard or normal expression level of a polypeptide of the present invention in an individual can be treated by administering the agonist or antagonist of the present invention. Thus, the invention also provides a method of treatment of an individual in need of an increased level of the polypeptide comprising administering to such an individual a Therapeutic comprising an amount of the agonist or antagonist to increase the activity level of the polypeptide in such an individual.

[01009] For example, a patient with decreased levels of a polypeptide receives a daily dose 0.1-100 ug/kg of the agonist or antagonist for six consecutive days. The exact details of the dosing scheme, based on administration and formulation, are provided in Example 13.

Example 15: Method of Treating Increased Levels of the Polypeptide

[01010] The present invention also relates to a method of treating an individual in need of a decreased level of a polypeptide of the invention in the body comprising administering to such an individual a composition comprising a therapeutically effective amount of an antagonist of the invention (including polypeptides and antibodies of the invention).

[01011] In one example, antisense technology is used to inhibit production of a polypeptide of the present invention. This technology is one example of a method of decreasing levels of a polypeptide, due to a variety of etiologies, such as cancer.

[01012] For example, a patient diagnosed with abnormally increased levels of a polypeptide is administered intravenously antisense polynucleotides at 0.5, 1.0, 1.5,

2.0 and 3.0 mg/kg day for 21 days. This treatment is repeated after a 7-day rest period if the treatment was well tolerated. The formulation of the antisense polynucleotide is provided in Example 13.

Example 16: Method of Treatment Using Gene Therapy-Ex Vivo

- [01013] One method of gene therapy transplants fibroblasts, which are capable of expressing a polypeptide, onto a patient. Generally, fibroblasts are obtained from a subject by skin biopsy. The resulting tissue is placed in tissue-culture medium and separated into small pieces. Small chunks of the tissue are placed on a wet surface of a tissue culture flask, approximately ten pieces are placed in each flask. The flask is turned upside down, closed tight and left at room temperature over night. After 24 hours at room temperature, the flask is inverted and the chunks of tissue remain fixed to the bottom of the flask and fresh media (e.g., Ham's F12 media, with 10% FBS, penicillin and streptomycin) is added. The flasks are then incubated at 37 degree C for approximately one week.
- [01014] At this time, fresh media is added and subsequently changed every several days. After an additional two weeks in culture, a monolayer of fibroblasts emerge. The monolayer is trypsinized and scaled into larger flasks.
- [01015] pMV-7 (Kirschmeier, P.T. et al., DNA, 7:219-25 (1988)), flanked by the long terminal repeats of the Moloney murine sarcoma virus, is digested with EcoRI and HindIII and subsequently treated with calf intestinal phosphatase. The linear vector is fractionated on agarose gel and purified, using glass beads.
- [01016] The cDNA encoding a polypeptide of the present invention can be amplified using PCR primers which correspond to the 5' and 3' end sequences respectively as set forth in Example 1 using primers and having appropriate restriction sites and initiation/stop codons, if necessary. Preferably, the 5' primer contains an EcoRI site and the 3' primer includes a HindIII site. Equal quantities of the Moloney murine sarcoma virus linear backbone and the amplified EcoRI and HindIII fragment are added together, in the presence of T4 DNA ligase. The resulting mixture is maintained under conditions appropriate for ligation of the two fragments. The ligation mixture is then used to transform bacteria HB101, which are then plated onto

agar containing kanamycin for the purpose of confirming that the vector has the gene of interest properly inserted.

[01017] The amphotropic pA317 or GP+am12 packaging cells are grown in tissue culture to confluent density in Dulbecco's Modified Eagles Medium (DMEM) with 10% calf serum (CS), penicillin and streptomycin. The MSV vector containing the gene is then added to the media and the packaging cells transduced with the vector. The packaging cells now produce infectious viral particles containing the gene (the packaging cells are now referred to as producer cells).

[01018] Fresh media is added to the transduced producer cells, and subsequently, the media is harvested from a 10 cm plate of confluent producer cells. The spent media, containing the infectious viral particles, is filtered through a millipore filter to remove detached producer cells and this media is then used to infect fibroblast cells. Media is removed from a sub-confluent plate of fibroblasts and quickly replaced with the media from the producer cells. This media is removed and replaced with fresh media. If the titer of virus is high, then virtually all fibroblasts will be infected and no selection is required. If the titer is very low, then it is necessary to use a retroviral vector that has a selectable marker, such as neo or his. Once the fibroblasts have been efficiently infected, the fibroblasts are analyzed to determine whether protein is produced.

[01019] The engineered fibroblasts are then transplanted onto the host, either alone or after having been grown to confluence on cytodex 3 microcarrier beads.

Example 17: Gene Therapy Using Endogenous Genes Corresponding To Polynucleotides of the Invention

[01020] Another method of gene therapy according to the present invention involves operably associating the endogenous polynucleotide sequence of the invention with a promoter via homologous recombination as described, for example, in U.S. Patent NO: 5,641,670, issued June 24, 1997; International Publication NO: WO 96/29411, published September 26, 1996; International Publication NO: WO 94/12650, published August 4, 1994; Koller et al., Proc. Natl. Acad. Sci. USA,

86:8932-8935 (1989); and Zijlstra et al., Nature, 342:435-438 (1989). This method involves the activation of a gene which is present in the target cells, but which is not expressed in the cells, or is expressed at a lower level than desired.

[01021] Polynucleotide constructs are made which contain a promoter and targeting sequences, which are homologous to the 5' non-coding sequence of endogenous polynucleotide sequence, flanking the promoter. The targeting sequence will be sufficiently near the 5' end of the polynucleotide sequence so the promoter will be operably linked to the endogenous sequence upon homologous recombination. The promoter and the targeting sequences can be amplified using PCR. Preferably, the amplified promoter contains distinct restriction enzyme sites on the 5' and 3' ends. Preferably, the 3' end of the first targeting sequence contains the same restriction enzyme site as the 5' end of the amplified promoter and the 5' end of the second targeting sequence contains the same restriction site as the 3' end of the amplified promoter.

[01022] The amplified promoter and the amplified targeting sequences are digested with the appropriate restriction enzymes and subsequently treated with calf intestinal phosphatase. The digested promoter and digested targeting sequences are added together in the presence of T4 DNA ligase. The resulting mixture is maintained under conditions appropriate for ligation of the two fragments. The construct is size fractionated on an agarose gel, then purified by phenol extraction and ethanol precipitation.

[01023] In this Example, the polynucleotide constructs are administered as naked polynucleotides via electroporation. However, the polynucleotide constructs may also be administered with transfection-facilitating agents, such as liposomes, viral sequences, viral particles, precipitating agents, etc. Such methods of delivery are known in the art.

[01024] Once the cells are transfected, homologous recombination will take place which results in the promoter being operably linked to the endogenous polynucleotide sequence. This results in the expression of polynucleotide corresponding to the polynucleotide in the cell. Expression may be detected by immunological staining, or any other method known in the art.

[01025] Fibroblasts are obtained from a subject by skin biopsy. The resulting tissue is placed in DMEM + 10% fetal calf serum. Exponentially growing or early stationary phase fibroblasts are trypsinized and rinsed from the plastic surface with nutrient medium. An aliquot of the cell suspension is removed for counting, and the remaining cells are subjected to centrifugation. The supernatant is aspirated and the pellet is resuspended in 5 ml of electroporation buffer (20 mM HEPES pH 7.3, 137 mM NaCl, 5 mM KCl, 0.7 mM Na₂ HPO₄, 6 mM dextrose). The cells are recentrifuged, the supernatant aspirated, and the cells resuspended in electroporation buffer containing 1 mg/ml acetylated bovine serum albumin. The final cell suspension contains approximately 3×10^6 cells/ml. Electroporation should be performed immediately following resuspension.

[01026] Plasmid DNA is prepared according to standard techniques. For example, to construct a plasmid for targeting to the locus corresponding to the polynucleotide of the invention, plasmid pUC18 (MBI Fermentas, Amherst, NY) is digested with HindIII. The CMV promoter is amplified by PCR with an XbaI site on the 5' end and a BamHI site on the 3' end. Two non-coding sequences are amplified via PCR: one non-coding sequence (fragment 1) is amplified with a HindIII site at the 5' end and an Xba site at the 3' end; the other non-coding sequence (fragment 2) is amplified with a BamHI site at the 5' end and a HindIII site at the 3' end. The CMV promoter and the fragments (1 and 2) are digested with the appropriate enzymes (CMV promoter - XbaI and BamHI; fragment 1 - XbaI; fragment 2 - BamHI) and ligated together. The resulting ligation product is digested with HindIII, and ligated with the HindIII-digested pUC18 plasmid.

[01027] Plasmid DNA is added to a sterile cuvette with a 0.4 cm electrode gap (Bio-Rad). The final DNA concentration is generally at least 120 µg/ml. 0.5 ml of the cell suspension (containing approximately 1.5×10^6 cells) is then added to the cuvette, and the cell suspension and DNA solutions are gently mixed. Electroporation is performed with a Gene-Pulser apparatus (Bio-Rad). Capacitance and voltage are set at 960 µF and 250-300 V, respectively. As voltage increases, cell survival decreases, but the percentage of surviving cells that stably incorporate the introduced DNA into their genome increases dramatically. Given these parameters, a pulse time of approximately 14-20 mSec should be observed.

[01028] Electroporated cells are maintained at room temperature for approximately 5 min, and the contents of the cuvette are then gently removed with a sterile transfer pipette. The cells are added directly to 10 ml of prewarmed nutrient media (DMEM with 15% calf serum) in a 10 cm dish and incubated at 37 degree C. The following day, the media is aspirated and replaced with 10 ml of fresh media and incubated for a further 16-24 hours.

[01029] The engineered fibroblasts are then injected into the host, either alone or after having been grown to confluence on cytodex 3 microcarrier beads. The fibroblasts now produce the protein product. The fibroblasts can then be introduced into a patient as described above.

Example 18: Method of Treatment Using Gene Therapy - In Vivo

[01030] Another aspect of the present invention is using *in vivo* gene therapy methods to treat disorders, diseases and conditions. The gene therapy method relates to the introduction of naked nucleic acid (DNA, RNA, and antisense DNA or RNA) sequences into an animal to increase or decrease the expression of the polypeptide. The polynucleotide of the present invention may be operatively linked to (i.e., associated with) a promoter or any other genetic elements necessary for the expression of the polypeptide by the target tissue. Such gene therapy and delivery techniques and methods are known in the art, see, for example, WO90/11092, WO98/11779; U.S. Patent NO. 5693622, 5705151, 5580859; Tabata et al., *Cardiovasc. Res.* 35(3):470-479 (1997); Chao et al., *Pharmacol. Res.* 35(6):517-522 (1997); Wolff, *Neuromuscul. Disord.* 7(5):314-318 (1997); Schwartz et al., *Gene Ther.* 3(5):405-411 (1996); Tsurumi et al., *Circulation* 94(12):3281-3290 (1996) (incorporated herein by reference).

[01031] The polynucleotide constructs may be delivered by any method that delivers injectable materials to the cells of an animal, such as, injection into the interstitial space of tissues (heart, muscle, skin, lung, liver, intestine and the like). The polynucleotide constructs can be delivered in a pharmaceutically acceptable liquid or aqueous carrier.

[01032] The term "naked" polynucleotide, DNA or RNA, refers to sequences that

are free from any delivery vehicle that acts to assist, promote, or facilitate entry into the cell, including viral sequences, viral particles, liposome formulations, lipofectin or precipitating agents and the like. However, the polynucleotides of the present invention may also be delivered in liposome formulations (such as those taught in Felgner P.L. et al. (1995) Ann. NY Acad. Sci. 772:126-139 and Abdallah B. et al. (1995) Biol. Cell 85(1):1-7) which can be prepared by methods well known to those skilled in the art.

[01033] The polynucleotide vector constructs used in the gene therapy method are preferably constructs that will not integrate into the host genome nor will they contain sequences that allow for replication. Any strong promoter known to those skilled in the art can be used for driving the expression of DNA. Unlike other gene therapy techniques, one major advantage of introducing naked nucleic acid sequences into target cells is the transitory nature of the polynucleotide synthesis in the cells. Studies have shown that non-replicating DNA sequences can be introduced into cells to provide production of the desired polypeptide for periods of up to six months.

[01034] The polynucleotide construct can be delivered to the interstitial space of tissues within an animal, including muscle, skin, brain, lung, liver, spleen, bone marrow, thymus, heart, lymph, blood, bone, cartilage, pancreas, kidney, gall bladder, stomach, intestine, testis, ovary, uterus, rectum, nervous system, eye, gland, and connective tissue. Interstitial space of the tissues comprises the intercellular fluid, mucopolysaccharide matrix among the reticular fibers of organ tissues, elastic fibers in the walls of vessels or chambers, collagen fibers of fibrous tissues, or that same matrix within connective tissue ensheathing muscle cells or in the lacunae of bone. It is similarly the space occupied by the plasma of the circulation and the lymph fluid of the lymphatic channels. Delivery to the interstitial space of muscle tissue is preferred for the reasons discussed below. They may be conveniently delivered by injection into the tissues comprising these cells. They are preferably delivered to and expressed in persistent, non-dividing cells which are differentiated, although delivery and expression may be achieved in non-differentiated or less completely differentiated cells, such as, for example, stem cells of blood or skin fibroblasts. *In vivo* muscle cells are particularly competent in their ability to take up and express polynucleotides.

[01035] For the naked polynucleotide injection, an effective dosage amount of

DNA or RNA will be in the range of from about 0.05 g/kg body weight to about 50 mg/kg body weight. Preferably the dosage will be from about 0.005 mg/kg to about 20 mg/kg and more preferably from about 0.05 mg/kg to about 5 mg/kg. Of course, as the artisan of ordinary skill will appreciate, this dosage will vary according to the tissue site of injection. The appropriate and effective dosage of nucleic acid sequence can readily be determined by those of ordinary skill in the art and may depend on the condition being treated and the route of administration. The preferred route of administration is by the parenteral route of injection into the interstitial space of tissues. However, other parenteral routes may also be used, such as, inhalation of an aerosol formulation particularly for delivery to lungs or bronchial tissues, throat or mucous membranes of the nose. In addition, naked polynucleotide constructs can be delivered to arteries during angioplasty by the catheter used in the procedure.

[01036] The dose response effects of injected polynucleotide in muscle *in vivo* is determined as follows. Suitable template DNA for production of mRNA coding for polypeptide of the present invention is prepared in accordance with a standard recombinant DNA methodology. The template DNA, which may be either circular or linear, is either used as naked DNA or complexed with liposomes. The quadriceps muscles of mice are then injected with various amounts of the template DNA.

[01037] Five to six week old female and male Balb/C mice are anesthetized by intraperitoneal injection with 0.3 ml of 2.5% Avertin. A 1.5 cm incision is made on the anterior thigh, and the quadriceps muscle is directly visualized. The template DNA is injected in 0.1 ml of carrier in a 1 cc syringe through a 27 gauge needle over one minute, approximately 0.5 cm from the distal insertion site of the muscle into the knee and about 0.2 cm deep. A suture is placed over the injection site for future localization, and the skin is closed with stainless steel clips.

[01038] After an appropriate incubation time (e.g., 7 days) muscle extracts are prepared by excising the entire quadriceps. Every fifth 15 μ m cross-section of the individual quadriceps muscles is histochemically stained for protein expression. A time course for protein expression may be done in a similar fashion except that quadriceps from different mice are harvested at different times. Persistence of DNA in muscle following injection may be determined by Southern blot analysis after preparing total cellular DNA and HIRT supernatants from injected and control mice.

The results of the above experimentation in mice can be used to extrapolate proper dosages and other treatment parameters in humans and other animals using naked DNA.

Example 19: Transgenic Animals

[01039] The polypeptides of the invention can also be expressed in transgenic animals. Animals of any species, including, but not limited to, mice, rats, rabbits, hamsters, guinea pigs, pigs, micro-pigs, goats, sheep, cows and non-human primates, e.g., baboons, monkeys, and chimpanzees may be used to generate transgenic animals. In a specific embodiment, techniques described herein or otherwise known in the art, are used to express polypeptides of the invention in humans, as part of a gene therapy protocol.

[01040] Any technique known in the art may be used to introduce the transgene (i.e., polynucleotides of the invention) into animals to produce the founder lines of transgenic animals. Such techniques include, but are not limited to, pronuclear microinjection (Paterson et al., Appl. Microbiol. Biotechnol. 40:691-698 (1994); Carver et al., Biotechnology (NY) 11:1263-1270 (1993); Wright et al., Biotechnology (NY) 9:830-834 (1991); and Hoppe et al., U.S. Pat. No. 4,873,191 (1989)); retrovirus mediated gene transfer into germ lines (Van der Putten et al., Proc. Natl. Acad. Sci., USA 82:6148-6152 (1985)), blastocysts or embryos; gene targeting in embryonic stem cells (Thompson et al., Cell 56:313-321 (1989)); electroporation of cells or embryos (Lo, 1983, Mol Cell. Biol. 3:1803-1814 (1983)); introduction of the polynucleotides of the invention using a gene gun (see, e.g., Ulmer et al., Science 259:1745 (1993); introducing nucleic acid constructs into embryonic pluripotent stem cells and transferring the stem cells back into the blastocyst; and sperm-mediated gene transfer (Lavitrano et al., Cell 57:717-723 (1989); etc. For a review of such techniques, see Gordon, "Transgenic Animals," Intl. Rev. Cytol. 115:171-229 (1989), which is incorporated by reference herein in its entirety.

[01041] Any technique known in the art may be used to produce transgenic clones containing polynucleotides of the invention, for example, nuclear transfer into enucleated oocytes of nuclei from cultured embryonic, fetal, or adult cells induced to

quiescence (Campell et al., Nature 380:64-66 (1996); Wilmut et al., Nature 385:810-813 (1997)).

[01042] The present invention provides for transgenic animals that carry the transgene in all their cells, as well as animals which carry the transgene in some, but not all their cells, *i.e.*, mosaic animals or chimeric. The transgene may be integrated as a single transgene or as multiple copies such as in concatamers, *e.g.*, head-to-head tandems or head-to-tail tandems. The transgene may also be selectively introduced into and activated in a particular cell type by following, for example, the teaching of Lasko et al. (Lasko et al., Proc. Natl. Acad. Sci. USA 89:6232-6236 (1992)). The regulatory sequences required for such a cell-type specific activation will depend upon the particular cell type of interest, and will be apparent to those of skill in the art. When it is desired that the polynucleotide transgene be integrated into the chromosomal site of the endogenous gene, gene targeting is preferred. Briefly, when such a technique is to be utilized, vectors containing some nucleotide sequences homologous to the endogenous gene are designed for the purpose of integrating, via homologous recombination with chromosomal sequences, into and disrupting the function of the nucleotide sequence of the endogenous gene. The transgene may also be selectively introduced into a particular cell type, thus inactivating the endogenous gene in only that cell type, by following, for example, the teaching of Gu et al. (Gu et al., Science 265:103-106 (1994)). The regulatory sequences required for such a cell-type specific inactivation will depend upon the particular cell type of interest, and will be apparent to those of skill in the art.

[01043] Once transgenic animals have been generated, the expression of the recombinant gene may be assayed utilizing standard techniques. Initial screening may be accomplished by Southern blot analysis or PCR techniques to analyze animal tissues to verify that integration of the transgene has taken place. The level of mRNA expression of the transgene in the tissues of the transgenic animals may also be assessed using techniques which include, but are not limited to, Northern blot analysis of tissue samples obtained from the animal, *in situ* hybridization analysis, and reverse transcriptase-PCR (rt-PCR). Samples of transgenic gene-expressing tissue may also be evaluated immunocytochemically or immunohistochemically using antibodies specific for the transgene product.

[01044] Once the founder animals are produced, they may be bred, inbred, outbred, or crossbred to produce colonies of the particular animal. Examples of such breeding strategies include, but are not limited to: outbreeding of founder animals with more than one integration site in order to establish separate lines; inbreeding of separate lines in order to produce compound transgenics that express the transgene at higher levels because of the effects of additive expression of each transgene; crossing of heterozygous transgenic animals to produce animals homozygous for a given integration site in order to both augment expression and eliminate the need for screening of animals by DNA analysis; crossing of separate homozygous lines to produce compound heterozygous or homozygous lines; and breeding to place the transgene on a distinct background that is appropriate for an experimental model of interest.

[01045] Transgenic animals of the invention have uses which include, but are not limited to, animal model systems useful in elaborating the biological function of polypeptides of the present invention, studying conditions and/or disorders associated with aberrant expression, and in screening for compounds effective in ameliorating such conditions and/or disorders.

Example 20: Knock-Out Animals

[01046] Endogenous gene expression can also be reduced by inactivating or "knocking out" the gene and/or its promoter using targeted homologous recombination. (See e.g., Smithies et al., *Nature* 317:230-234 (1985); Thomas & Capecchi, *Cell* 51:503-512 (1987); Thompson et al., *Cell* 5:313-321 (1989); each of which is incorporated by reference herein in its entirety.) For example, a mutant, non-functional polynucleotide of the invention (or a completely unrelated DNA sequence) flanked by DNA homologous to the endogenous polynucleotide sequence (either the coding regions or regulatory regions of the gene) can be used, with or without a selectable marker and/or a negative selectable marker, to transfect cells that express polypeptides of the invention *in vivo*. In another embodiment, techniques known in the art are used to generate knockouts in cells that contain, but do not express the gene of interest. Insertion of the DNA construct, via targeted homologous recombination,

results in inactivation of the targeted gene. Such approaches are particularly suited in research and agricultural fields where modifications to embryonic stem cells can be used to generate animal offspring with an inactive targeted gene (e.g., see Thomas & Capecchi 1987 and Thompson 1989, *supra*). However this approach can be routinely adapted for use in humans provided the recombinant DNA constructs are directly administered or targeted to the required site *in vivo* using appropriate viral vectors that will be apparent to those of skill in the art.

[01047] In further embodiments of the invention, cells that are genetically engineered to express the polypeptides of the invention, or alternatively, that are genetically engineered not to express the polypeptides of the invention (e.g., knockouts) are administered to a patient *in vivo*. Such cells may be obtained from the patient (i.e., animal, including human) or an MHC compatible donor and can include, but are not limited to fibroblasts, bone marrow cells, blood cells (e.g., lymphocytes), adipocytes, muscle cells, endothelial cells etc. The cells are genetically engineered *in vitro* using recombinant DNA techniques to introduce the coding sequence of polypeptides of the invention into the cells, or alternatively, to disrupt the coding sequence and/or endogenous regulatory sequence associated with the polypeptides of the invention, e.g., by transduction (using viral vectors, and preferably vectors that integrate the transgene into the cell genome) or transfection procedures, including, but not limited to, the use of plasmids, cosmids, YACs, naked DNA, electroporation, liposomes, etc. The coding sequence of the polypeptides of the invention can be placed under the control of a strong constitutive or inducible promoter or promoter/enhancer to achieve expression, and preferably secretion, of the polypeptides of the invention. The engineered cells which express and preferably secrete the polypeptides of the invention can be introduced into the patient systemically, e.g., in the circulation, or intraperitoneally.

[01048] Alternatively, the cells can be incorporated into a matrix and implanted in the body, e.g., genetically engineered fibroblasts can be implanted as part of a skin graft; genetically engineered endothelial cells can be implanted as part of a lymphatic or vascular graft. (See, for example, Anderson et al. U.S. Patent No. 5,399,349; and Mulligan & Wilson, U.S. Patent No. 5,460,959 each of which is incorporated by reference herein in its entirety).

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